Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

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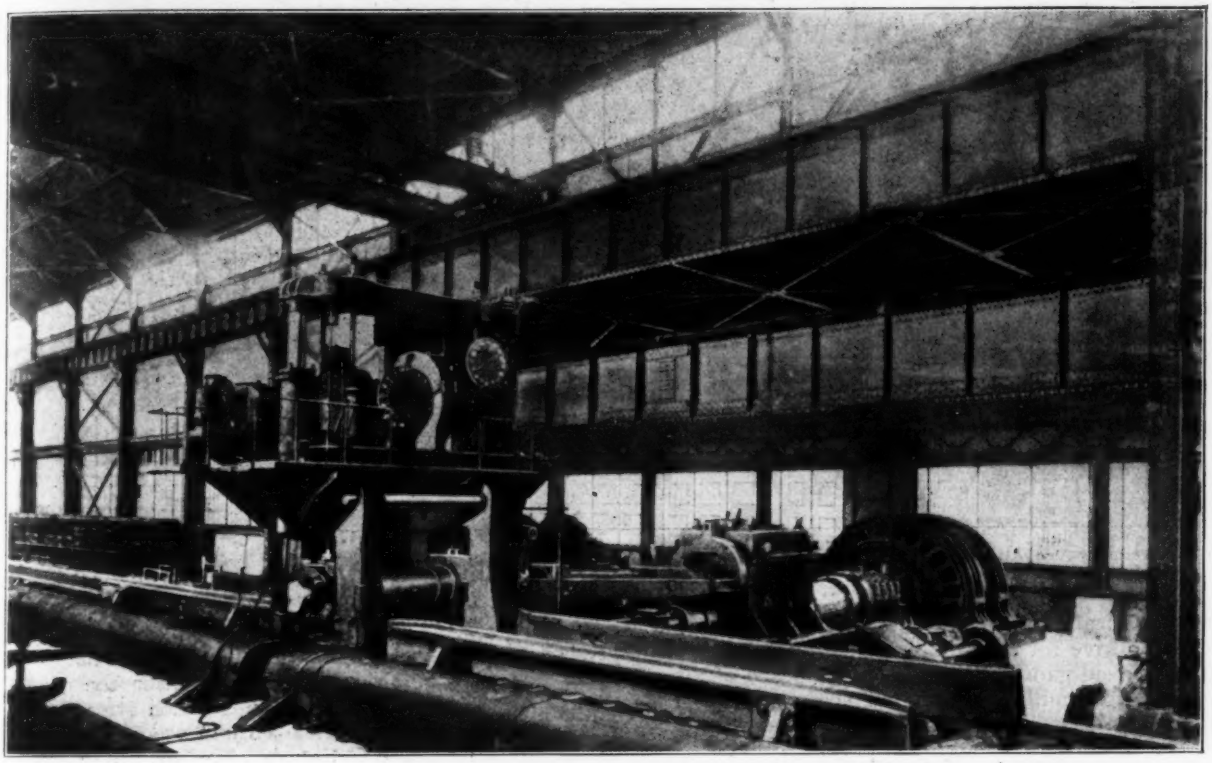


General View of 27-in. Reversing Universal Plate Mill, Mark Plant of the Steel & Tube Co. of America, Indiana Harbor, Ind.—This Mill Has Established An Unusual Productive Record, Having Rolled in One Month 17,393 Tons of Plates Averaging Under 3/8 In. Thick.

Steel-Mill Electric Drive — Present Status and Recent Developments

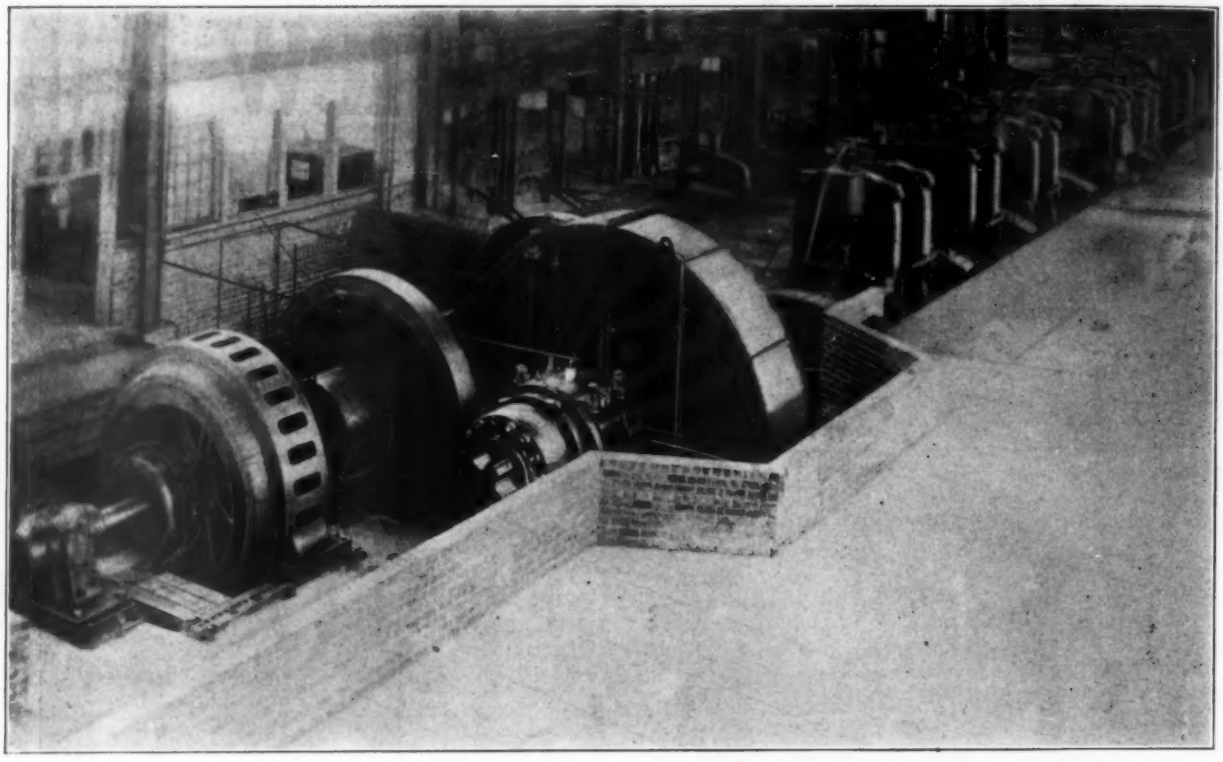
Value of Electrical Operation Shown During War—Special Motor Design Frequently Justified—Problem Best Treated on Plant Basis — Tendency Toward Central-Station Service

By BRENT WILEY

THE motor-operated steel mill today is practically an accepted standard type of driving unit. Its use has been almost universal during the last several years, and over a period of 12 years totals more than 550 units, aggregating approximately 850,000 hp. All classes of steel mills are included in the list and a review of the results that have been accomplished by this improved type of drive gives emphasis to the many general advantages of electrification.

Electrical manufacturers have given much attention to the study and analysis of steel-mill conditions and requirements and have developed suitable apparatus for all classes of steel-mill work, including the auxiliary machines and main rolls. The success of the modern mill, however, is the result of the combined efforts of the steel companies, the mill builder and the electrical manufacturer. Such points as practical limits of draft, roll speed and temperatures of rolling have a direct bearing on the mill output and power requirements, and before considering such matters as motor capacity it is extremely important to establish the rolling schedule and conditions as definitely as possible and obtain a practical basis for estimating.

Much credit is due the Association of Iron and

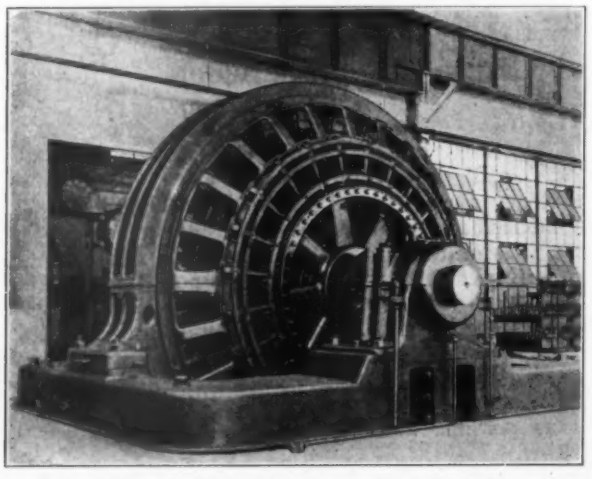


1500-hp. Westinghouse Alternating-Current Motor Connected to Sheet Mill Through Gear Drive, Canton Sheet Steel Co., Canton, Ohio.

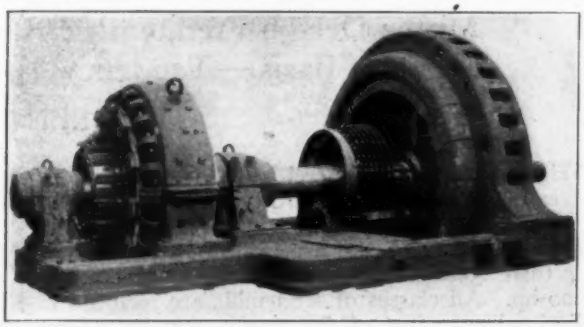
Steel Electrical Engineers for the rapid development of electric drive for steel mills and its extensive application. This organization, which is composed of more than 300 steel-mill electrical engineers and several hundred associate members interested in steel-mill activities in an indirect way, has presented more than 200 papers on subjects pertaining to electrical apparatus and use of electricity in the iron and steel industry and is devoting much attention to the subjects of standardization, technical analysis of field data, and other broad matters which will advance the art of mill electrification.

The broad and varied experiences obtained in motor-operated mills during the war period of the last three years has demonstrated the several advantages of electric drive with unusual emphasis. Many mills were planned, built and put in operation to meet extreme emergency demands for various war steel products. Time was an important factor and electric drive was a favorable means of facilitating the construction of the plant. Many items which are necessary with the steam-engine-driven mill are eliminated, including boiler plant and extra buildings. While in some cases it was necessary to enlarge the plant electric station, this work was not a large item when the time and expense involved was distributed over the several mills usually included in the new addition. In many cases central-station power was used which eliminated the power generating entirely. It was possible to obtain the electrical equipment within a period that was consistent with the delivery of mill machinery.

The flexibility of mill operation with electric drive has permitted a wide range of product and a variation



Reversing Motor Unit for 27-in. Reversing Plate Mill of Mark Plant.



Westinghouse 1500-hp. Adjustable-Speed Alternating-Current Motor Set for Direct Connection to 18-in. Merchant Mill, Carnegie Steel Co. Duquesne Plant.

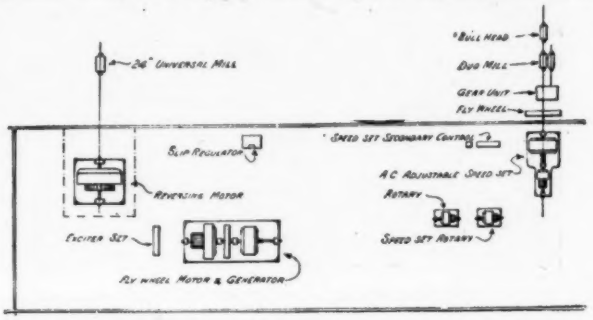
in mill schedule which has materially assisted in rolling the most advantageous sections and has been a material factor in increasing the tonnage. In three-high mills the adjustable-speed alternating-current

motor drive gives a wide range of speed with a variation ranging in many cases up to 40%. The equipment can be designed for either constant-horsepower or constant-torque requirements, but a majority of mills require approximately a constant-horsepower proposition.

It is consistent with good practice to include in the motor design special characteristics to best suit the particular mill requirements, as this can be done with but little sacrifice of motor efficiency or mechanical features. In one case a heavy plate mill was installed with a direct-connected slow-speed motor without flywheel included, which would have meant a wheel of exceptional weight. With the largest practical flywheel capacity that could be utilized the peak loads were estimated to be large and it was decided to eliminate the flywheel, thereby reducing the all-day friction losses and provide suitable characteristics in the motor to meet the demands of the high peak loads. A motor having a pull-out torque of four times the normal load torque was installed. The size of the motor (7500 hp.) and the load requirements made a gear drive impractical.

A wide latitude in mill layout is permitted by the use of herringbone gears which permits the selection of speed of driving unit through a wide range. The development of suitable reduction gears has reached a most satisfactory state within the last few years and today a large majority of mills, the average of which requires about a 1500-hp. unit, are installed with moderate-speed motors and gear reduction. This is favorable to the idea of standardization, as it keeps the large units within a more limited speed range. The motor has better characteristics, including efficiency and power-factor, and the desired margin of mechanical safety factors can be secured to a more positive degree, which is one of the main advantages of standardization. The first cost of the complete drive, including motor and gears is less as a rule and the efficiency of operation is improved as compared with direct-connected drives for many applications.

One of the principal developments of recent years has been the reversing-mill motor equipment. Its success has been very marked and its adoption is quite general today. A number of mills of recent design include a reversing roughing stand and tandem arrangement of mill which gives the plant greater flexibility of size of product and increases the tonnage with a decrease in power requirements. Plate mills, strip mills and structural mills are some of those in the list. Unlike the steam drive, which calls for unusual steam supply for a reversing equipment, the reversing motor drive acts as an equalizer for the three-high continuously operated mills, as the power taken from the supply line is quite uniform for the

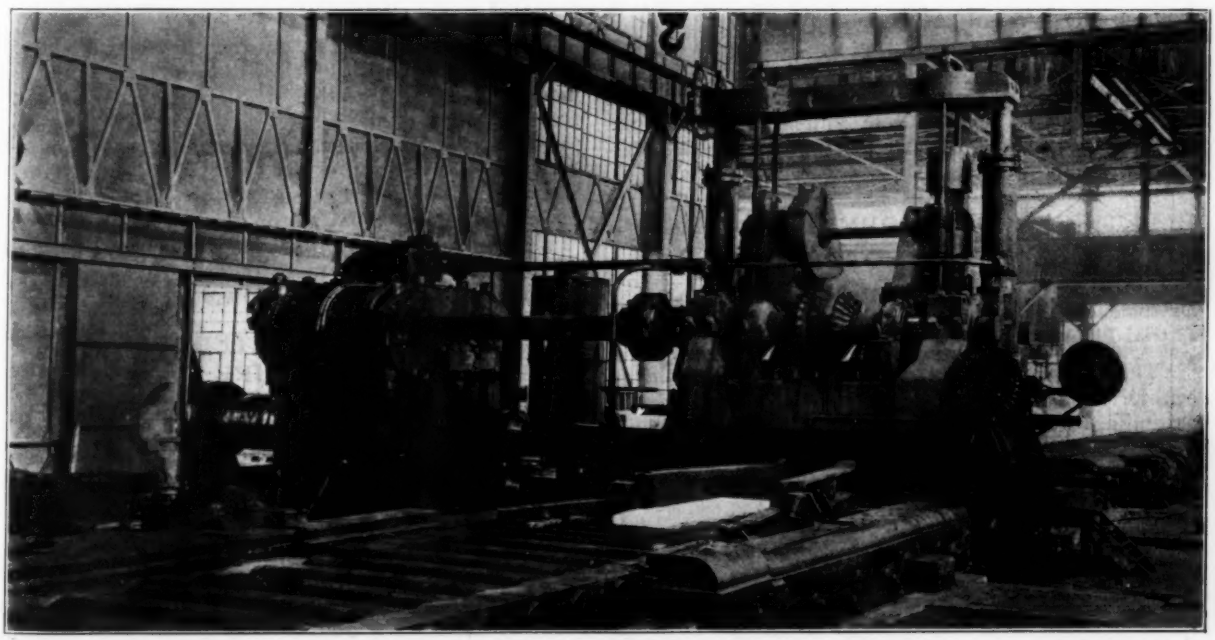


General Arrangement of 24-in. Heavy Strip Mill, National Pressed Steel Co., Massillon, Ohio—Note the Tandem Arrangement of Mills, Which Includes a Reversing 24-in. Universal Roughing Mill Equipment.

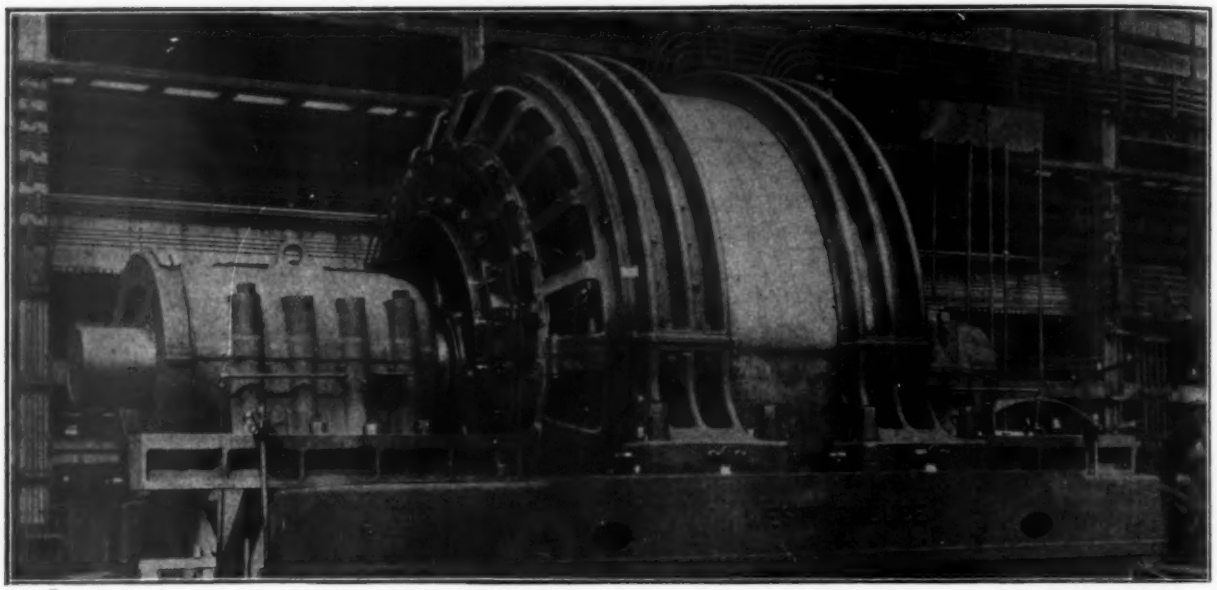
former, and intermittent with high peak loads for the latter type of mill.

The question of electric power supply for large motor drives has received broader consideration during the last few years. Many plants have found it an advantage to analyze their requirements and future improvements from a complete plant standpoint and thus give each individual mill proposition the benefit of its relation to the plant proper and thus properly distribute general charges and enable the advantages of the motor drive to be capitalized as a part of the general scheme of improvement.

Remarkable possibilities have been shown on this basis, but when the individual mills are analyzed as



General View of 35-in. Blooming Mill Driven by 15,000-hp. Motor, Mark Plant of Steel & Tube Co. of America.



Type of Reversing Motor Used for Driving 35-in. Blooming Mill in Mark Plant—View Shows Motor Set Up in Manufacturer's Shops—Rating of Motor Used is 15,000 hp.

segregated propositions the summary of the advantages of motor drive do not establish the true over-all plant efficiency.

One of the noteworthy features of recent practice is the selection of large-size turbine units and a more liberal policy to provide for general plant electrification. This tends to improve the efficiency of power production, as the water rate of the large-size turbines is materially better than for the size of units formerly selected for mill use. During the past year, turbines ranging from 15,000 to 20,000 kw. have been selected for steel mills, as compared with the 5000-kw. turbine which was about the average of the units formerly installed.

A more common use of central-station power has been made during the war period in particular. It has been a factor in facilitating installations and also offers many advantages of reduction of first cost of plant, reduced cost of operation and permits of greater flexibility of plant layout for future improvements. More than 50% of the motor equipments installed during the last two years use central-station power and more than 60% are 60-cycle units. The tendency towards the adoption of 60-cycle apparatus as a standard is very marked.

ELECTRICAL DEVELOPMENT ACTIVE IN WASHINGTON.

Extensions of Power Lines and Power Supply to Industrial Plants Typical of Pacific Northwest Activities.

The Pacific Northwest Traction Co., with Northern Division headquarters at Bellingham, Wash., is extending a power line 3 miles to Avon to furnish energy for about 150 hp. in motors at the gravel pit of the Kaiser Paving Co., to operate conveyors, pumps and screens.

The employes of the Puget Sound Traction, Light & Power Co., at Bellingham, Wash., have organized the Whatcom County Power & Light Co., by which a transmission line carrying 6600 volts has been built 6 miles from the Guide-Meridian highway to Ferndale, supplying energy for lighting the town and furnishing power for motor drive of 100 hp. in the Mt. Vernon cream condenser at Ferndale. The manager of the new company is R. U. Muffley, who is superintendent of light and power for Puget Sound Traction, Light & Power Co. at Bellingham.

The last named company is extending a 55,000-volt transmission line from its main power line to the Bellingham coal mine, just outside the city limits of Bellingham. At its coal mine terminal there will be installed a substation with a 1000-kv-a. transformer, receiving energy at 55,000 volts, 3 phase, stepping it down to 2300 volts for the mine equipment, which will have a connected load of about 1000 hp. In the mine operations, the air compressors, pumps, hoists, ventilating fans, conveyors and shop tools will be operated by alternating-current motors; but for the electric locomotive for haulage of coal to the tipple direct current will be required, for the production of which a motor-generator set is to be installed. The tipple is under construction and a 30° slope, 7 by 10 ft., is being driven, which is to cut the coal vein at the vertical depth of 266 ft. below the surface. The coal body was opened at that depth some time ago by a vertical shaft.

The Bloedel-Donovan Lumber Co. has completed and put in operation a box factory at Bellingham requiring motors aggregating 650 hp., in which all machines have individual motor drive. The Puget Sound Traction, Light & Power Co. extended a 2300-volt, three-phase line one mile long to this plant where power is stepped down to 440 volts for the motors.

MUNICIPALLY OPERATED RAILWAYS A FAILURE.

The following is quoted from the *Minneapolis News:*

"In the opinion of Dean John R. Allen, of the college of engineering of the University of Minnesota, municipally operated street railways are a gigantic failure.

"In theory, he told members of the Minnesota Section of the A. I. E. E., public ownership is excellent; in practice it is a fizzle wherever he has seen it tried. The address was given in an open discussion on street railway matters at the engineering college recently."

Western Practice in the Testing of Insulators

Various Tests, Equipment, Crews Required and Results Obtained—Report of Insulator Committee Presented Before Pacific Coast Section N. E. L. A.

THIS report is a *resumé* of tests as used and adopted by the various operating companies of the Pacific slope together with the effectiveness of same, and a brief description of equipment and limitations of the various methods.

In the case of crew equipment no camp or cooking facilities have been included. This will, of course, have to be added in numerous cases.

High-Duty Megger Testing.

Equipment.—Megger having at least 1000-volt generator and suitable scale that will detect resistance values between 2000 megohms and infinite and preferably 5000 megohms and infinity. Suitable tripod equipped with small table on which megger can be placed and leveled. Sufficient reinforced lamp cord for connection between insulator under test and megger. Two-prong fork with 4-ft. wood handle. Two line grounding devices and two hand lines. Total weight of apparatus 80 lb., one light truck.

Crew.—A crew of four men, consisting of two linemen, one megger-man and a driver have been found efficient for this work, and basing figures on an 8-hour day, they will test from 200 to 700 link insulators per day, depending on the number of insulators used per string, height of towers or poles and accessibility of lines, the majority of the time being required for climbing poles or towers, together with setting up and leveling megger. The megger has proved itself well adapted for testing link insulators in places on the line where more than one unit is used per string, and from the records of various power companies on the Pacific coast, as shown in Table II, it will be seen that megger tests can be relied upon in all but a few cases.

Limitations.—Where a single suspension unit or one-piece pin insulators are used, it is necessary to remove same from the line before testing by megger. The parts of pin insulators having two or more shells can be meggered provided suitable contact is made to moistened cemented surfaces on both sides of the shell. This, however, is a slow and tedious process and we do not believe has ever been used for testing units in any great number.

The high-duty megger will not give good results in foggy or rainy weather and, in general, trouble will be experienced on account of cloudy or humid days. When difficulty is experienced on account of damp weather, it is possible to get fairly reliable results by using the guard terminal after having properly cleaned the insulator, and in times of very severe weather conditions the insulator can even be coated with oil for the period of testing. The time required and possibilities of not obtaining all the surface leakage current through the guard terminal places damp weather testing in the emergency class, and in general should only be resorted to for emergency conditions.

Insulators subjected to salt-water spray or to trade winds near the ocean shore will be very difficult to megger and in general results are not very reliable. Link insulators next the wire and the tower in long suspension and dead end strings will usually show slightly lower megger reading than those in the center of the string, even though the insulators be in good condition.

The present high-duty megger will not always detect interior cracks in heavy porcelain parts which are entirely free from moisture, but there are few localities on the Pacific coast where the atmosphere is so dry that the cracks do not soon become moisture

TABLE No. 1.

Testing apparatus		Pin insulators				Link insulators			
		One piece		Built up		One unit per string.		More than one unit per string.	
		Tested in laboratory	Tested in place on structure	Tested in laboratory	Tested in place on structures	Tested in laboratory	Tested in place on structure	Tested in laboratory	Tested in place on structure
MEGGER	Suitable except in extremely wet or dry climates.	Can be used	Not suitable	Can be used	Individual parts can be tested but cement must be wetted to get results.	Can be used	Not suitable	Can be used	Can be used
60 CYCLE HIGH VOLTAGE	Most conclusive test.	Can be used	Not suitable	Can be used	Suitable extreme case	Can be used	Suitable extreme case	Can be used	Suitable extreme case
OSCILLATOR	Will detect defects away from cap in dry insulators. Will some times pass low megohm insulators.	Can be used	Not suitable	Can be used	Not suitable	Can be used	Not suitable	Can be used	Not suitable
INDUCTION COIL	Results intermediate between oscillator and 60 cycle high voltage. Detects cracks as well as porous insulators.	Can be used	Not suitable	Can be used	Can be used	Can be used	Not suitable	Can be used	Can be used
TELEPHONE DETECTOR	Will not detect between leakage over dirty insulator.	Not suitable	Can be used, limited	Not suitable	Can be used, limited	Not suitable	Can be used limited	Not suitable	Can be used, limited

laden, in which case the megger is very effective. If the voltage of the megger generator could be raised to 5000 volts or above, this defect of not detecting internal cracks in dry insulator caps would be largely eliminated.

Test Standard.—Any good insulator with clean, dry surfaces should have an insulation resistance of from ½ to ¾ million megohms so that if an insulator has reached a resistance value of 2000 megohms or below, it should be discarded as the length of time that it might still be of some use is generally very short and not to be considered.

At times of humid weather conditions it may be necessary to carry two or three good insulators for checks when all insulators give low reading due to surface moisture.

In most places testing with megger can only be successfully done in the daylight hours and then commencing several hours after sunrise and stopping before sunset. The actual length of time testing can be carried on will depend upon the time of year, proximity of insulators under test to water, and the humidity of the atmosphere.

The effectiveness of systematic megger testing is shown by the records of one power company operating about 325 miles of 100,000 volt circuits. The practice is to megger all units once every two years and the places where highest depreciation is occurring once every year.

The lines were first meggered in 1914-15, then again in 1917.

The string of failures which in general indicate service interruptions were as follows:

Prior to meggering—0.5 of 1%.
First year after meggering—0.1 of 1%. (This figure is unduly high on account of not changing all insulators at time of test.)
Third year—.06%, while during 1918 the company did not lose a single string of suspension or dead-end insulators on the whole 325 miles of the line.

The majority of these link insulators were manufactured in 1907-1908, and have been in service since that date.

60-Cycle High-Voltage Test.

Equipment.—Sixty-cycle source. Suitable voltage control apparatus. Transformers of ample voltage range to flash over the largest single porcelain unit or piece to be tested.

Series gap. Suitable testing racks and leads.

Crew.—One tester, two tester assistants.

Limitations.—The series gap should always be used in 60-cycle testing. By observing the color and character of the arc across the gap, porous porcelain can be detected. The reddish glow of the arc in the series gap will indicate porous material while the arc will have a bluish "snappy" appearance, that of charging current, for good material.

The test standard for low-frequency testing will vary, depending on the material tested. Suspension insulators of the later designs should be subjected to flashover four or five times before acceptance, while the thin shells of the older pin type designs should only be subjected to a voltage slightly below flashover for a period of 5 seconds.

This method of testing is considered the best laboratory method and it has been used in field laboratory work. One of the largest operating companies of California is seriously considering developing a low frequency test for checking insulators in place. It is possible to detect porous shells on pin insulator with-

TABLE No. II.

NAME OF COMPANY	INSULATORS				LINE DATA					TESTING DATA							RESULTS		
	Type	Units per string	Parts per Unit	Manfrs. Rating per Unit Volts	Poles of Steel Towers	Conductors per Tower	Arrangement of Wires on Tower	Distance Between Wires	Towers per Mile	Apparatus Used	Duration of Test	Frequency of Impact Voltage	Scale of Megger	Voltage of Megger	Standard Required to Pass Test	Per cent Below Standard	Where are Insulators Tested	How Often Tested	Size of Testing Crew	Failures in Year Prior to Test	Failures in Year Following Tests
Southern Sierras Power Co.	Link	6	1	16,500	Towers	6	Vertical	10 ft.	8	O. S. C. Motor and 60 in. Transformer	5 sec.	200,000			Flashover for period of test		In field removed from tower	1st time	11		
San Diego Consol. Gas & Electric Co.	Link	5-6 6-7	1	16,000	Wood Poles		Tri'ngle	6 ft., 8 in	12	Megger in field. 5kw, 200kv in laboratory.			1,000	500	Remove those which vary from average. 70 kv flashover.		In place on towers. All insulators removed are tested in laboratory	Not decided	2		
Portland Railway Light & Power Co.	Link	3-4-5	1	90,000 Dry 56,000 Wet	Towers	3	Vertical	6 ft.	11	Megger			2,000	1,000	200 megs before removal. 2000 megs in laboratory.		In place on towers		5		
Los Angeles Gas & Electric Co.	Pin-Link	— 2	2 1	27,000 18,000	Wood Poles	3/6	3 Horiz. 6 Vert.	3 ft.	45	Megger			5,000	1,000	2000 megs	5% first time 1% second time	In place on poles	2 tests have been made, 1 year apart	3		
Pacific Gas & Electric Co.	Link Pin	7 —	1 4	10,000 to 20,000 60,000	Steel Towers Wood Poles	3 3	Vertical Tri'ngle	10 ft. 6 ft.	6.6 20	Megger Induction coil			2,000 to 5,000	1,000	2000 megs. Parts must behave same as a known standard		In place on towers and poles	Not decided	4 3		
Puget Sound Traction Light & Power Co.	Link Pin	3 —	1 4	25,000 60,000	Steel Towers Wood Poles	6 3	Tri'ngle and Vertical	6 ft., 7 in.	10 18-30	Wireless telephone receiver							In place on towers	At least once a year	2	1%	Negible
Great Western Power Co.	Link	6	1	Thomas 1053	Steel Towers	6	Vertical	10 ft.	8	Megger			2,000	1,000	2,000 megs	3½%	In place on tower.	Every two years	4	0.5% 0.1%	0.06% None

out subjecting the thin parts to flashover and the possible breakage due to the power arc.

When testing porcelain with low-frequency high voltage, care should be used to properly protect the test equipment against any heavy current flow or the breakage from the heat generated in the arc will be unduly high.

Oscillator Testing.

Equipment.—High-voltage oscillator having ample voltage range to flashover pin insulator or one unit of suspension string. Suitable voltage control equipment for handling oscillator. Alternating-current voltage source. Crates for handling insulator strings or units to and from towers or poles to field laboratory. Hand lines and grounding devices. Two trucks, total weight 4000 lb.

Crew.—Four linemen, 2 groundmen, 1 tester, 1 test assistant and 1 truck driver.

Limitations.—Because of the size and weight of the equipment, the oscillator is not adapted for testing insulators in place; hence, must be used for laboratory work. This test laboratory, however, may be readily arranged so it can be transported by auto truck.

The oscillator will not detect certain classes of porous moisture laden insulators. In very dry climates where cracking is the predominant fault in the defective insulators, the oscillator will give good results.

A crew of nine men could remove, test and replace from 200 to 600 units per day, depending upon the number of units per string and the strings per tower. Insulators should stand flashover for at least a five-second period for acceptance.

Spark Coil.

Equipment.—Spark coil of sufficient size and voltage range to flashover unit or part of a multi-piece unit. Ignition battery for operating spark coil. Suitable insulated leads for high voltage terminal. Two grounding devices for line equipment. Weight of equipment, 80 lb. One light truck or touring car.

Crew.—Two linemen, 1 groundman, 1 tester and 1 driver. Can test 150 to 500 units per day in place.

Limitations.—The spark coil and oscillator are quite similar except the spark coil is of lower frequency and made in smaller sizes so that it is more portable than the oscillator. The spark coil is better adapted for testing the individual pieces of a three or four-part pin insulator than the megger. Perfect contacts with the cemented surfaces on both sides of a porcelain part are not so essential with the spark coil. It will detect porous porcelain or cracks and can be used in places where weather and surface conditions would exclude the megger.

A shunt gap is used across the terminals of the coil and the quality of the insulator is judged by the length of gap that will arc-over while insulator is under test.

Telephone Detector Tests.

Equipment.—Wireless receiver head set. Battery and insulated wire. Suitable light pole, 10 or 15 ft. in length, equipped with sharp metal point. Short metal rod for earth contact. In some cases a crystal detector is used to increase sensitiveness with satisfaction, and the Audion amplifier has been used.

Crew.—One specially trained, careful lineman.

Limitations.—The telephone detector tests are generally used as a shunt circuit on the wood pole to detect leakage current to earth through the pole. The arcing and overstressing of insulator parts give rise to high frequency currents which will give a distinctive tone in the receiver.

On wood pole construction by going to the cross-arm it is generally possible to locate the pin or link string in question, but when the more sensitive devices are used in connection with short antennae on steel towers, only the tower can be determined.

The troubles with these devices are that in general you cannot distinguish between a faulty and a dirty insulator. This is particularly true if it is some of the older pin type designs in which certain of the petticoats may be over-stressed due to dirty caps. Thus with many of the older design pin insulators in the fall of the year the first fog or light rain would tend to show all insulators faulty.

On account of the lightness and simplicity of this test it can be used to advantage at times if one realizes its many faults. It will in general at least indicate that the insulators are dirty and should be cleaned, and in many cases the faulty insulators can be determined while the line is in operation, which cannot be said of any of the other methods of test.*

*Complete details and limitations of tests will be found in A. I. E. E. Proceedings, in article by M. T. Crawford, vol. 33, page 1429, and article by B. G. Flaherty, vol. 35, page 1095 together with discussions.

HYDROELECTRIC DEVELOPMENT ON NEW ILLINOIS STATE WATERWAY.

The proposed Illinois state waterway or canal between near Lockport, at the end of the Chicago Drainage Canal, and La Salle, the present head of navigation on the Illinois River, is expected to be under construction before many months. Its cost will be about $20,000,000 and it will be excavated in or along the Des Plaines and Illinois Rivers, by dredging in the earth sections and blasting in the rock portions. When completed it will serve as a connecting link between navigation on the Great Lakes and the Mississippi River and tributaries.

Building of this canal will involve destruction of the present dam and water power on the Des Plaines River at Jackson street, near the center of the city of Joliet. In its place it is proposed to build a larger dam and hydroelectric plant 4 miles further south, at Brandon's road, where nearly 40,000 hp. may be developed. The Sanitary District of Chicago is seeking authority from the State Legislature to lease this proposed new power and add it to its electrical system supplying Chicago and some two score other municipalities nearby. This would just about double the capacity of the Sanitary District's supply, which is now limited to about 40,000 hp., obtained from the District's hydroelectric plant at the terminus of the Drainage Canal, a few miles below Lockport.

INCREASED MANUFACTURE OF ELECTRIC HEATERS IN SWEDEN.

The use of electricity for heating purposes is comparatively new, but since the enormous water power in Sweden and Norway has been increasingly utilized, and especially because of the acute shortage of fuel during the war, electric heating has become more and more extensive in Scandinavia. Elektriska A. B. Volta was organized in Stockholm in 1915, with a capital stock of $32,160, for the manufacture of electric heating apparatus. In the beginning this factory employed 40 men, but at the end of 1917 the number had increased to 500.

Electrical Precipitation of Solids from Flue Gases

Some Practical Observations on Application of the Cottrell Precipitation Process to the Waste Gases of Smelters —Apparatus Used, Operating Conditions and Troubles

By J. M. WAUCHOPE

Chief Electrician, International Smelting Co., Toole, Utah.

THERE has been developed in the past few years a method of precipitating the solids held in suspension in flue gases that is proving of great value to many industries, such as smelters, metal refineries, etc., that have been troubled with damage suits caused by the waste fumes, not to mention the values lost in them. The process is based on the inventions and patents of Dr. F. G. Cottrell, being known as the Cottrell process, and the plants as Cottrell plants.

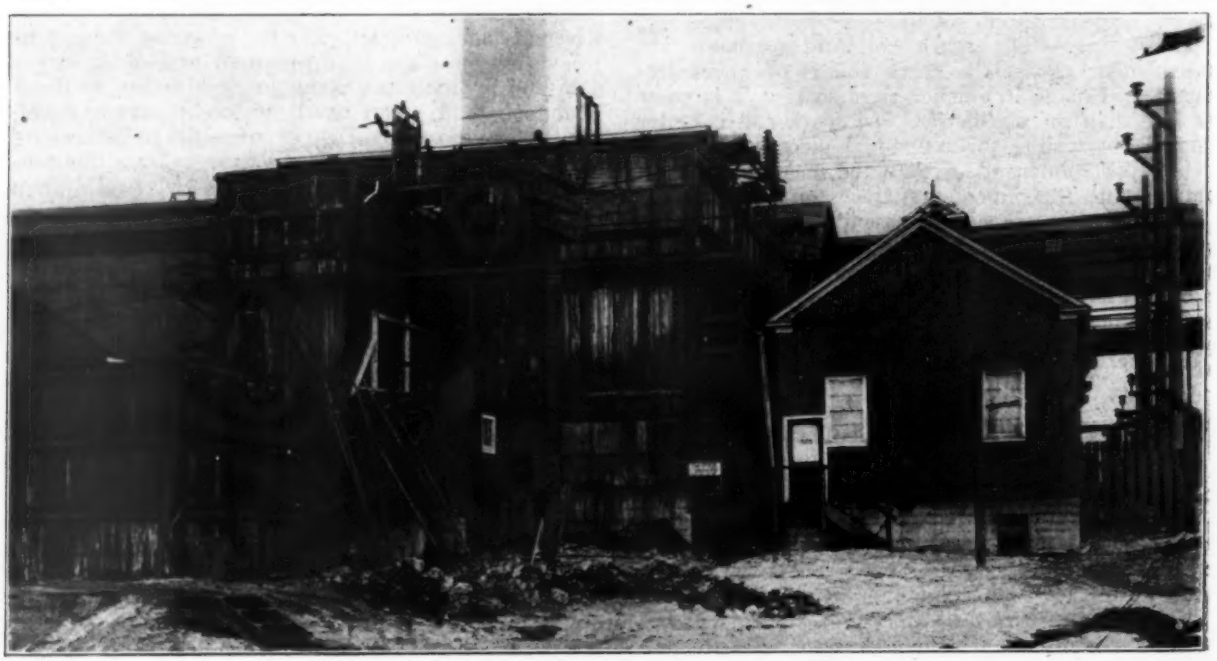
The process is based on the principle that in a gas containing solids held in suspension on being passed through a strong electrostatic field the particles are electrified and deposited on the electrodes. This field must be produced by a direct current for the best results. The electrodes are commonly iron pipes from 6 to 12 in. in diameter for the positive, which is grounded, while the negative is a wire suspended in the center, the pipes being vertical and the gases passing up through them.

Electrical Station Equipment Required.

The station equipment for producing the high-tension direct current for the treater may be divided into two systems which are in common use. One that can be called system A, uses individual motor-generator sets for each treater with the rectifier direct-connected to the common shaft of the set. The set consists of an induction motor, a single-phase generator of 220 or 440 volts, and the rectifier. This generator supplies the power for the step-up transformer from which the high-tension current is taken to the rectifier to be changed into the direct current for use in the treater. This transformer is usually wound for a maximum voltage on the high side of 100,000 volts with taps that will give several steps down to 50,000.

The other system, which will be called system B, differs from A in that a motor-generator is not used, the current for the step-up transformer being taken directly from the power mains, if they are of 220 or 440 volts, or through a transformer if of a higher voltage. The rectifier in this case is operated by a synchronous motor, as it is very necessary that it be in step with the current supplied to the high-tension transformer.

The rectifier consists of a disk of Micarta, Bakelite or similar insulating material, about 30 in. in diameter, mounted on the extended shaft of the motor-generator set in system A or direct-connected to the synchronous motor in system B, so that in either case it can be kept in step with the current supplied to the high-tension transformer. On this disk are mounted contacts which pass very close to, but do not touch,



Exterior View of Treater and Substation Buildings.

other stationary brushes or sectors, these varying in details in different styles of rectifiers, but the principle of operation remaining the same. In the later types there are four stationary sectors; to two diametrically opposite ones the leads from the high-tension transformer are connected; to the other two the direct-connected leads are connected, as shown in the illustrations. The action of the rectifier is to turn one-half of the alternating-current wave over so that there is a pulsating direct current flowing, not all of the wave being rectified.

With system A, using individual motor-generator sets for each treater unit, the high-tension treater circuit is electrically separate from the power mains, which has been claimed to be the best method to use as there can be no danger to other apparatus from high-tension disturbances on the treater circuit. With system B it has been feared that since it is electrically connected to the mains these high-voltage surges might cause trouble. This, however, has not been the writer's experience, as no trouble has been caused by this system.

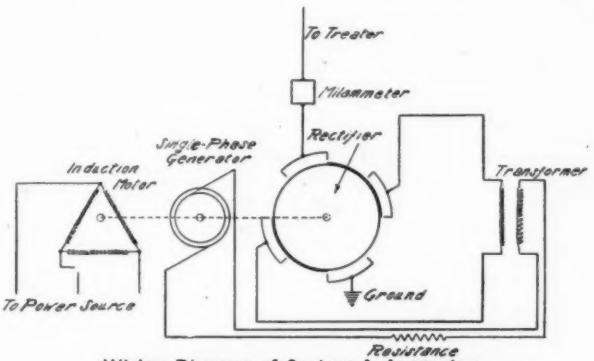
Interior of Substation, Showing Arrangement of Apparatus and Guard Netting.

With system A there is often a tendency to snap on the rectifier when conditions in the treater are not good, which is not nearly so noticeable on system B. There seems to be a greater tendency to surge with A than B, the larger power supply of B tending to act as a damper to smooth out the wave. The writer has had plants under his charge that gave constant trouble while operating on A, but which as soon as changed to B gave practically none.

Operating Conditions in the Station.

With both systems it is nearly always necessary to have a certain amount of resistance in the low-tension alternating-current circuit to the step-up transformer to act as a ballast in steadying operation and in some cases a very high resistance is used in both the alternating-current and direct-current leads to and from the rectifier. These are rods averaging 150,000 ohms. Choke coils are usually mounted on the transformer terminals for its protection, while in some cases an inductance is used in the direct-current circuit to good advantage, it being especially valuable in cases where there is a persistent tendency to snap on the rectifier. The rectifier should operate with a reddish colored arc, the less of the white snapping the better. The more inductance in the circuit the redder it will be and larger. If the rectifier has adjustable brushes they should be spaced about equally round the disk for best average operation; although under some conditions it may be necessary to vary them, this should be avoided if possible.

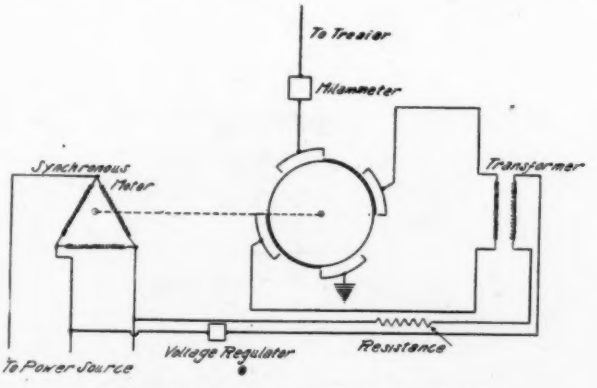
The milammeter used in the direct-current circuit is of great aid in good operation as an experienced



Wiring Diagram of System A Apparatus.

operator by taking its reading, together with the voltage, can form a good idea of the treater conditions, for usually a high milliampere reading and low voltage means trouble, although this is not an infallible rule. This meter is usually placed in the outgoing line to the treater, although it has been placed on the switchboard and connected in the ground side; this, however, has a certain element of danger in it as it might happen that the ground connection would become defective, in which case a very high voltage would be impressed on the instrument. The direct current will ordinarily average in the neighborhood of 50 to 300 or 400 milliamperes, this varying with gas conditions and, of course, the area of the surfaces in the treater being used.

The voltage in common use runs from 20,000 to 75,000, this depending on the distance between the electrodes and gas conditions. The direct-current voltage may be taken roughly as 80% of the high-tension alternating-current voltage, this varying with brush setting and treater conditions to some extent. The direct-current voltage is generally read by means of a sphere gap, as this is cheap and easily made; an electrostatic voltmeter is used sometimes. In using



Wiring Diagram of System B Apparatus.

the sphere gap a high resistance is connected in series with it to limit the current flow when used.

As the voltage on the electrodes in the treater should be kept as near the arcing point as possible to secure the best results, this means a very close control of the voltage and, since this varies often due to the gas and other things in the treater (such as air leaks, more or less moisture, velocity of the gas, and amount

of dust on the electrodes) it has been the custom with system A to do this with the rheostats in the generator and exciter fields together with the taps on the high-tension transformer. With system B it has been done with resistance in the low-tension side of the step-up transformer in connection with the variable-ratio taps. In the latest plants induction voltage regulators are used also. The variable-ratio taps are taken to a switch on the board for convenience, but in normal operation they are seldom used. The winding of the voltage regulator is of benefit in the low-tension circuit as it acts as a ballast in aiding steady operation, it being necessary in nearly all cases to have a certain amount of resistance in circuit at all times.

Conditions in the Treater.

In the treater, which is usually composed of vertical pipes with wires suspended in their centers, the gas is passed up through the pipes. Thus being compelled to pass through the electroststic field, the dust is deposited on the pipes principally although some collects on the wires. When the pipes and wires are shaken the dust falls into hoppers underneath from which it is taken away. In later types of treaters a different arrangement is used, the gases being passed horizontally between stands of small ¼-in. pipes which are charged negatively. Between these stands of pipes are the positive electrodes, made of sheet iron and grounded, these being shaken and the dust collected in hoppers as in the other type. In the first type the vertical pipes are from 6 to 12 in. in diameter, very seldom larger, the voltage necessary running from 20,000 to 50,000. The wires are suspended from an insulated support on the upper end and are held and guided by a similar support on the lower end. The tension on the wires must be kept sufficient to keep them from vibrating as, if they become loose, the strain caused by the static field will start them vibrating which in turn will cause arcing between the wires and pipes. The insulators used in the treater should be located so as to be easily gotten at to clean and inspect or change, as it is very important to keep them in the best condition. The most rugged type, both mechanically and electrically, should be used as the service on them is very severe. It is often necessary to introduce moisture into the gases for best results, but this introduces another difficulty which is that the acids thereby formed are very destructive.

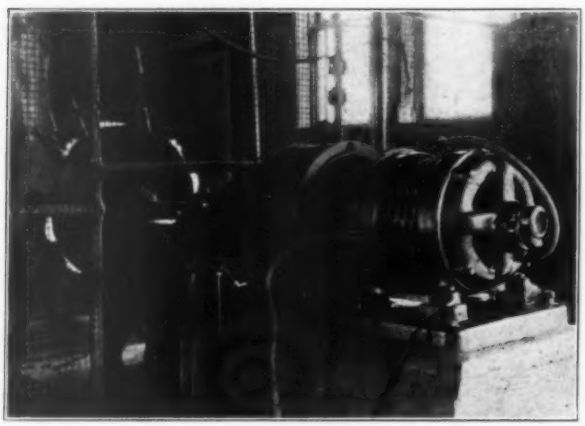
The velocity of the gases should not be too rapid or they will not be acted on thoroughly, nor should they be too hot, nor too dry nor too wet. The proper conditions can best be determined by trial. It is necessary to shake the deposits from the pipes and wires often enough so that they will not interfere with operation, the gases being shut off while this is being done so that the draft will not carry them away. The proper intervals at which to shake can best be determined by experience and this with the inspection should be done faithfully to get good results. It is a good plan to have an arrangement so that when the operator opens the treater to inspect the device he will at the same time ground the wires to prevent anyone being hurt through carelessness. The wires formerly used were of some noncorrosive composition, such as Nichrome, but iron wire is now being used as it is so much cheaper. The even distribution of the gases is very important through the treater pipes as is an even quality. The best place to build the treater is near the stack and as far from the furnaces as possible. This also tends to give an even temperature in the treater which is an aid to good operation.

Common Operating Troubles and Remedies.

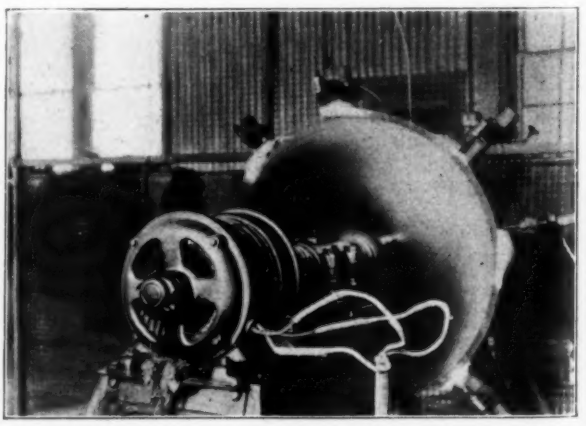
A few of the common troubles an operator may meet will be mentioned as follows:

If in starting up the arc flashes entirely around the rectifier, look for broken wires or insulators as the rectifier has a choking effect and the voltage may not be raised high enough to cause the circuit-breaker to open. With system B using the synchronous motor on the rectifier, as these motors have very small torque, the rectifier may not be in synchronism and as it varies in position with regard to the alternating-current wave the arc will increase and die down at small intervals, in which case look for bad bearings or excessive friction in the set. If there is a persistent tendency to snap, see if the treater is too dry, or in case water is used, too wet. In case the catch suddenly falls off, look for air leaks into the treater or changes in the gas conditions. If on starting up after a shutdown the milliamperes go unusually high while no voltage can be obtained, look for broken insulators or wires which cause short circuits; also look for collections of dust on the insulators, as they must be kept clean for good results. Keep the moving and stationary contacts on the rectifier in good condition, truing them and resetting as they burn away.

Finally, it may be said that the process is yet far



Typical System A Apparatus, Including Motor-Generator and Rectifier—Arcs on Latter Are Visible, Also Resistance Rods in High-Tension Leads.



Typical System B Apparatus, Including Synchronous Motor Direct-Connected to Rectifier—Arcs on Brushes of Latter Are Well Shown.

Switchboard for Four-Unit Installation.

from being fully developed and much remains to be learned. There is a very large field for its use in many different industries and new uses are continually being found.

ELECTRICAL EQUIPMENT OF NORWAY-PACIFIC STEEL SHIPYARD.

All Machinery Electrically Driven, Power Being Supplied from Central Station—Connected Load Will Aggregate 3000 kw.

By W. A. Scott.

The city of Everett, Wash., acquired a substantial industry when the Norway-Pacific Construction & Dry Dock Co. decided in 1918 to establish a plant there for the building of steel ships. The plant is now well along toward completion insofar as the 5-way yard is concerned. The construction of the dry dock, however, has not been begun, nor has that of the machine shop. The 24-acre yard consists of filled ground at the water front, the foundation of all buildings and heavy equipment resting upon wooden piles. The buildings are of timber construction with the exception of the boiler house and air-compressor building which are of clay tile construction.

The electrical installations, providing for a connected load of about 3000 kw., are of special interest. Energy from the central station of the power company is delivered at 2300 volts, three-phase, 60 cycles, at the Norway-Pacific's open-air transformers of 450-kv-a. capacity, situated within the yards. Here the energy is stepped down to 440 volts. Plans provide for a 600-kv-a. bank of transformers to serve the proposed dry docks with power at 440 volts. Lighting of buildings and yards will be distributed from four or five transformer stations by which 2300-volt energy will be stepped down to 220-110 volts, single-phase, three-wire, the aim being not to distribute at low potential over 300 ft.

The 2300-volt distribution is to be carried by lead-covered cable within iron conduit. All lighting distribution will be by rubber-covered wires in iron conduit. The distribution throughout is all underground, except the main 2300-volt service that leads to the control bus in the compressor house.

The air-compressor house contains three Bury compressors, each direct-connected to a 650-hp. Electric Machine Co. synchronous motor, to have a speed of 180 r.p.m. In this building there is being installed an Electric Machinery Co. 300-kw. motor-generator set supplying 250 volts direct current for the crane motors. In this installation there will be two generators on the same shaft with the motor. The intention is, also, to put in another motor-generator set of 250 kw. to supply direct-current energy at 110 volts to the cells of the electrolytic oxygen-hydrogen generating plant.

The main switchboard is 42 ft. long, with 24-in. panels, using standard oil switches and disconnecting switches, the former being the General Electric Co. industrial type with overload relays.

The principal motors being installed are of the Wagner type, except the synchronous motors referred to. In addition to those, however, are a number of 3-hp. and 5-hp. motors furnished by the United States Electric Co., these being direct-connected to grinders, making up a complete unit. The motor load in the fabricating shop amounts to about 430 hp., for operating bending and straightening rolls, punches, shears, plate planers, blowers and other tools. In all the arrangements for motor drive, only a small amount of belting is used, the motor connections to the various machines and tools being either by gearing or direct coupling.

One of the important features of the plant consists of the electric crane installations with their direct-current motors. One of these is that of a gantry crane being furnished by the Wellman-Seaver-Morgan Co. This is for wharf service, having a rotating hinged boom mounted upon a self-supporting traveling tower that has a travel of 1500 ft. around the outfitting pier. It is equipped with two bridge motors of 20-hp. each, one motor of 35-hp., for the hoist, a similar motor for boom hoisting and one of 20 hp. for boom slewing. This crane equipment will be served from below through a slot in the yard decking by using a contact shoe and a 30-lb. conductor rail. Each of the five shipways is being equipped with two Pawling & Harnischfeger 5-ton overhead cranes, each one covering half of a 64-ft. span. All these are equipped with Wagner direct-current motors. The fabricating shop, covering an area of 100 by 600 ft., is served by three Ederer Engineering Co. 5-ton cranes.

The buildings are wired in metal conduit and the shop lighting being provided consists of Mazda C lamps of 100 to 500 watts, with dome reflectors, for general illumination; each machine and shop tool will be separately lighted by a 40-watt lamp, provided with a proper reflector. The mold loft, 100 by 300 ft., having open-truss roof supports, will be served by indirect lighting in which X-Ray reflectors are to be used. The ceiling is made to serve as a light reflector and fire resistant by the application of a white magnesia mixture.

A 150-hp. boiler was installed to supply steam for heating purposes and to furnish power for two steam hammers.

All machinery and equipment were furnished on the company's specifications, the electrical installations being made under supervision of A. Shipek, chief electrician. The C. Kirk Hillman Co., of Seattle, sales agent for several electrical manufacturers, sold the electrical equipment required in the plant.

Editorial Comment

Electrical Co-operation on the Coast

ONE of the outstanding features of the joint convention of the Pacific Coast Section, N. E. L. A., with the jobbers and contractor-dealers that was held last week at Coronado, Cal., was the fine spirit of co-operation shown between these different branches of the electrical industry that have so frequently clashed in many other sections of the country. While co-operation has been quite generally advocated for many years, our Pacific Coast friends have been quietly carrying it out. Nowhere else has it been made so effective and successful. The Pacific Coast has set a splendid example for the rest of the country from which we may all profit.

Use Receptacles for Appliances

AT THE suggestion of the chief of the San Francisco Department of Electricity, the Pacific Coast convention at Coronado last week adopted resolutions strongly advocating teaching the public the need for wall receptacles for proper use of heating appliances instead of connecting these to the ordinary fixture sockets. This matter has been brought up before at odd times but little concerted effort has been made to bring it home to the public. It is high time that the various electrical interests woke up to the fact that they have nothing to lose by getting behind this movement, rather is there much to gain through the more convenient and safer use of appliances thereby made possible.

Prospects for Early Peace

REPORTS from Paris indicate favorable prospects for early conclusion of peace with Germany. Formal termination of the war is therefore probably only a matter of a few weeks. Impatient as many have been over the peace conference, the fact remains that in less than four months it has conducted the most far-reaching and important international negotiations ever undertaken in history. The extraordinary difficulties involved in harmonizing the many conflicting interests are little appreciated. The final peace settlements are essentially a compromise of different ideas and ideals and, while they may not please everyone, are doubtless the best that could have been drafted under all the existing conditions.

The point of chief importance to remember is that the peace treaties should bring to a close not only the greatest war of mankind, but what has been probably the most widespread period of human unrest, social and economic as well as political, that has ever convulsed this earth. Actual conclusion of peace should, therefore, be made the occasion of the universal return to the orderly activities of peace—development of the arts, sciences, industries, commerce and the pursuit of happiness.

Auspicious Resumption of Building

FROM many sections of the country are being received pleasing reports of a marked resumption of building activities. These include not only numerous public works but an extended construction of dwellings and apartments. The latter will meet the serious dearth of housing facilities that has been causing anxiety in many cities. A particularly auspicious feature of this revival of building is that it has been undertaken in spite of continued high prices of materials and labor, the public realizing more and more that these high prices are evidently here for a protracted stay. The building industry is closely connected with many other industries, including the electrical. Its renewed activity, therefore, will doubtless have a wholesome effect on business.

Experience with Electrical Precipitation

THE Cottrell process of electrostatic precipitation of solid particles from flue gases has become firmly established in smelting plants, cement mills and other works, so that its value and practicability are no longer questioned. The time is now ripe for discussing operating conditions in the light of experience, so that difficulties occasionally encountered in its use may be overcome and its applicability extended. On other pages in this issue we publish an article by Mr. J. M. Wauchope in which these features are considered and helpful suggestions made for avoiding troubles. Frank discussions of this character will be found of value in clearing up misconceptions and in aiding more intelligent operation of the equipment. The operator who is anxious to make the most of this interesting process cannot have too much reliable information at his disposal.

Steel-Mill Electric Drive Progressing

DURING the war the demand for steel was so great that the application of time, labor and money-saving methods in steel mills made considerable headway. This accounts for the substantial increase in the use of electric rolling-mill drive during the last few years and makes opportune a review of the present status of this most exacting application of electric power. We are fortunate in being able to

present such a review in this issue from the pen of Mr. Brent Wiley, one of the best known authorities on this subject. He shows how the problem of steel-mill electrification often lends itself to the use of specially designed motor and control systems in order to secure the best all-around results. The tendency to use central-station power that he reports will be welcome to many power companies. Steel-mill drive affords the best example for showing the adaptability of the electric motor to meet the heaviest and severest loads. Its further development should therefore prove of special interest to all power engineers.

Pacific Coast Practice in Insulator Testing

ONE of the chief aims of the operating engineer is to keep operating, maintaining service in face of all difficulties. The doctrine is that prevention is better than cure; that it is better to prevent cessation of service than to renew it, however meritorious the manner of renewing it may be. One of the chief problems facing the engineer operating high-voltage transmission lines is that of maintaining his lines against storms, against landslides and other causes of damage. And not least, perhaps, of the factors contributing to service interruptions is that of insulator deterioration and failure. Insulator maintenance, detection of deterioration and replacement of defective units, thus is a matter of prime importance to the transmission engineer.

The transmission lines and systems of the Pacific Coast are many and vast. They cover an enormous territory of varying topography. The potentials employed are among if not actually the highest employed commercially. These lines parallel the sea coast with its salt-laden sea fogs; they traverse the long stretches of the country with their intense heat from the direct rays of the sun and the sand dust and the heavy rains. Every form of climatic change, except that of intense cold, is encountered, sometimes rapidly in quick succession. Thus the insulator problem has assumed importance of the first moment, not only because of the climatic changes to be met, but because of the large number of insulators involved, the long distances over which they are scattered, and the dependence placed upon the energy transmitted.

Because the transmission lines of different companies have covered different stretches of country subject to different climatic conditions, troubles of different sorts have been encountered and different palliatives and alleviative measures found. A porous insulator is not as objectionable in a dry, clean locality as in a locality where the atmosphere is dust-laden one day and saturated with moisture the next. It is these reasons that explain why the various operating companies have adopted various methods of detecting deteriorating and defective insulators.

An article appearing elsewhere in this issue represents data on detecting deteriorating or defective insulators that should be of very great value to operating men. These data apply not to one company meeting certain conditions but to six companies meeting practically all conditions pertaining to the Pacific Coast states. This article points out five methods of testing insulators *in situ* some without interferring with the functioning of a line. It tells which of the large operating companies adhere to each method, the limitations and salient advantages of each and the apparatus and men required for each.

The megger method, much heralded a few years ago, is useful, but the fact that its reliability is so dependent upon atmospheric conditions—humidity, fog, etc.—and the necessity of making good contact at the right place upon the insulator, makes it a seasonal method. The 60-cycle, high-voltage and oscillator methods are laboratory rather than field methods, because of the bulky and heavy apparatus required. The spark-coil method requires only a small crew and is superior to the megger method in many ways, notably in that it is independent of climatic conditions. The telephone receiver method gives good results on wooden poles, has limitations on steel towers since it indicates a tower carrying defective insulators but not which of the insulators are defective. Another fact that should be borne in mind is that discrimination betwen a dirty and a defective insulator cannot be made with certainty. The appartaus required is, however, light and compact and the work can be carried on rapidly by one man without interfering with the transmission of power.

Checking up the condition of insulators, detecting insulators that are deteriorating before they become so defective as to cause a service interruption is better than waiting until harm is done. The various methods employed for doing this, why various companies prefer one method to other methods, and the limitations of each should prove interesting and instructive reading to all concerned in maintaining potential upon transmission lines.

Back to Private Control

THE announced determination of the Federal Administration to hand back to private control the wire communication system of the country is charged with unusual significance. For many years the most determined efforts have been made to wrest from private ownership and place under the control of the Federal Government the telegraph and the telephone systems of the country. Under the stress of war conditions, upon extraordinary authority conferred upon the President, the way was opened for the taking over of the wire systems and indulging in the experiment of government control.

When the lines passed to the Government the systems had reached a remarkable degree of efficiency in organization and management. Through a series of splendid developments a gigantic network covered the

country, rendering good service, amply and ably financed, and with a laboratory and operating personnel for which only commendation was possible. So tolerant were the people of the country in their effort to make any sacrifice, either business or personal, in order that the Government might not be embarrassed and so great were the opportunities to make a good showing, that the resulting retrogression of the service is a glittering commentary on the inadequacy of the department to the direction of which was assigned the handling of the situation. The greatest significance lies in the fact that what is presumed to be one of the most efficient arms of the Government failed in the handling of a system which came to it with conditions eminently prepared to work out a successful issue.

This brings us to a rather unusual stepping back and away from an ideal which has long been cherished by the exponents of government ownership of public utilities. And it would not seem to be the part of unwisdom to conjecture that the announcement of this policy will retard rather than foster the idea and its application to other utilities in the near future. Excellent as the Post Office Department is as an institution in general, and reasonable and logical as are the reasons for continuing this one element of service under government direction, even its administration indicates the unwisdom of the Government attempting the restriction, regulation and operation of another public utility.

Governmental affairs require two kinds of workers—those who direct and those who carry the load. Those who serve must needs give up in some degree the freedom of personal operation that is permitted and considered a privilege in ordinary commercial life. Either through intense patriotism and a desire to serve or through fear of consequences, a degree of self-abnegation that is utterly undemocratic makes the governmental employe tolerant of the conditions which surround him. Such conditions of service attract, on the one hand, good men who look upon their own achievements with an unappreciative eye, and, on the other hand, a long line of mediocrities who choose the service as a refuge rather than a career. Big thoughts, big actions and a toleration of the other man's viewpoint and an acquiescence in that viewpoint are not found in this direction. Regarding the mediocrities no comment need be made. With the men of large accomplishment who are content to undervalue their own achievements and thus participate in an unappreciated service, it would seem that the very characteristics which make possible this anomalous condition in a subtle way render them incapable of the vision, enthusiasm and imagination which are required in the accomplishment of big things.

Big men—really big men—in public service have always been a disappointment. The restrictions which encompass their operations rob them of the opportunity they possess in commercial life to display those attributes of daring which make for commercial success. The initial hindering of authority and the lack of ultimate responsibility are upper and nether millstones between which many a brilliant man from public life has had his enthusiasm and ability ground into the impotent dust of negative performance.

If these cogitations have any semblance of verity the conclusion must follow that it is inevitable that those things upon which the commercial fabric of the country depends must be managed by commercial men, under the rules of procedure followed in commercial enterprises, and that the rewards for successful accomplishment must be measured by the tithe which the public gladly gives for service well rendered.

The public is not niggardly; it has demonstrated its willingness to stand by the Government under any and all conditions; it has indicated its willingness to pay the price of acquiring and holding its ideals, and, properly informed with regard to the complexities and responsibilities of public service, it will pay the way.

However, the public will demand of private ownership or control as high a degree of efficiency as it is possible to attain if the demand for an adequate compensation is yielded to. It will not do to smuggle inefficiency into the rates. The development of engineering products has received a tremendous impetus during the last decade and particularly during the period of the war new standards of service and a new appreciation of conservation and economy have been evolved. There can be no slipping back to slipshod methods.

Buy Your Copper Now

TRUE to form, copper is fluctuating with the law of supply and demand. Few other products indicate more truly, unerringly and more quickly the state of the market. The price of copper is a barometer of conditions.

With the vast production brought suddenly to a halt with war's cessation came a slump in demand and the inevitable slump in price. The government restricted price of 23 cents tumbled to 15 cents and less just because of the absence of demand and huge supplies on hand. Today many copper plants are shut down, most of the larger ones are operating at half capacity, although conditions are improving gradually toward a normal market and supply, and production is going on upon a 60% basis.

When the war made its frenzied call for copper, more copper, the price soared, production multiplied and enormous quantities were produced. Then war's demands ceased suddenly, unexpectedly, with the inevitable result that production swamped the demand and prices avalanched down. Today copper is selling at 16 cents a pound. Tomorrow or the next day, the copper market will have attained its equilibrium again when the peace-time callings get into swing. Meanwhile the time to buy copper is now.

Week's Events

Edison Medallist — Biggest Hydraulic Turbines — Pacific Coast Joint Conventions Promote Further Co-operation

EDISON MEDAL TO BE PRESENTED TO B. G. LAMME.

Program for Annual Meeting of American Institute of Electrical Engineers, May 16.

The annual business meeting of the American Institute of Electrical Engineers will be held May 16 in the auditorium of the Engineering Societies Building, New York City, at 8:30 p. m. At this meeting the Board of Directors will make its annual report, including a complete financial statement for the year ended April 30, 1919. The report of the tellers will also be presented, giving the results of the election of officers for the ensuing administrative year. The Weaver Memorial Tablet, which is to be erected in the headquarters of the Institute "in acknowledgement of the services rendered to the Institute and to the electrical engineering profession by William D. Weaver," will be exhibited at this meeting.

Immediately following the business meeting will take place the ceremony of the presentation of the Edison Medal. This medal was founded by the Edison Medal Association, composed of associates and friends of Thomas A. Edison, and is awarded annually by the American Institute of Electrical Engineers "For Meritorious Achievement in Electrical Science, Electrical Engineering, or the Electric Arts."

The Edison Medal has been awarded this year to Benjamin G. Lamme "for invention and development of electrical machinery," and the presentation ceremonies will be as follows:

"The Edison Medal," by Carl Hering, chairman, Edison Medal Committee.

"Achievements by Benjamin G. Lamme," by B. A. Behrend.

Presentation of the Medal, by Wm. B. Jackson, vice-president, A. I. E. E.

Response, by Benjamin G. Lamme.

Non-members of the Institute are cordially invited to attend this meeting and ladies are welcome.

Career of Benjamin G. Lamme.

Benjamin G. Lamme was born on a farm near Springfield, Ohio, in 1864, and graduated from Ohio State University as a mechanical engineer in 1888. The subjects in which he has been particularly interested since his student days are analytical, especially mathematical and mechanical problems.

He entered the Testing Department of the Westinghouse Electric & Manufacturing Co., May 1, 1889, and has now been associated with the company continuously over 30 years. The company was then engaged almost exclusively in the manufacture of alternating-current apparatus for incandescent lighting. The development of practically all types of polyphase alternating-current apparatus and railway generators and motors was a matter of the future, in which Mr. Lamme took a leading part. He has invented and designed much of the apparatus and many of the systems and methods which are now in general use. He has received about 140 patents, many of which are of fundamental importance and cover inventions which have contributed very largely to the prevailing methods of generating, transmitting and using electrical power. He has been a leader in the development of the induction motor, polyphase generator, synchronous converter, single-phase railway apparatus and direct-current railway apparatus.

In 1900 he was made assistant chief engineer, and since 1903 he has been chief engineer of the company.

Benjamin G. Lamme, Who Will Receive the Edison Medal Next Week.

Aside from his personal engineering activities, he acts in an advisory capacity to the whole engineering interests of the company. He is chairman of the company's committee which passes upon new inventions and appliances. Mr. Lamme has been an acknowledged leader during the past twenty-five years in the engineering work of the Westinghouse company, and many advances in the general use of electricity are due to his ingenuity and ability and dis-

criminating judgment in directing and passing upon the engineering work of others.

He is the author of many technical papers presented before engineering societies, some of which are regarded as classics, not only because of their technical worth, but because of their clear and lucid style. A paper on the induction motor published 18 years ago, is used in many schools and permission has recently been given for including it in the textbooks of the Naval Academy at Annapolis. His inventions and writings have made him well known among electrical engineers in Europe as well as in America.

In 1915, upon nomination by the American Institute of Electrical Engineers, Mr. Lamme was appointed by the Secretary of the Navy to membership on the Naval Consulting Board, and his services as a member of the Board during the war have been of great value to the country.

THE 52,500-HP. HYDRAULIC TURBINES FOR NIAGARA FALLS.

Largest Capacity Turbines Being Built for New Niagara Falls Development of Hydro-Electric Power Commission of Ontario.

The two turbines being built by the Wellman-Seaver-Morgan Co., Cleveland, Ohio, for the above development will have a capacity of 52,500 hp. each, when operating at 187½ r.p.m. under a normal head of 305 ft.

The turbines will be of the single-runner vertical type, discharging downward into a single draft tube. The turbine casings will be of cast steel, of spiral form. The gates will be of the balanced wicket type, operated through suitable mechanism by a governor located on the generator floor.

The throat of the spiral casing leading to the runner will be spanned by a speed ring having ribs or vanes properly designed to direct the water to the turbine gates. The weight of the rotating turbine parts and the hydraulic thrust on top of the runner will be carried by a thrust bearing located on top of the generator.

All of the gate mechanism, except the gates themselves, will be outside of the water passages and accessible for adjustment and repair.

The runner will be approximately 10 ft. in diameter. The casing will have an inlet diameter of about 10 ft. and will discharge approximately 1800 cu. ft. of water per second.

These turbines, when installed, will be by far the largest capacity hydraulic turbines in existence.

NEW YORK LEAGUE SUBSCRIBES LIBERALLY FOR VICTORY LOAN.

Subscriptions Amounting to $50,000 Secured at Recent Luncheon.

Several interesting addresses were delivered at the New York Electrical League luncheon which was held on April 29 at the Hotel McAlpin. Maj. David A. L'Esperance of the 369th infantry, formerly the New York 15th national guard, spoke of the wonderful bravery and accomplishments of the troops of this regiment. It was mustered into the United States service Aug. 17, 1917, under Col. William Haywood and holds the record for continuous front line trench service, 191 days. This regiment compiled an enviable record and received three decorations of the French Legion of Honor out of 61 conferred on United States troops. Major L'Esperance received one of these and also the Croix de Guerre, but of this he did not speak.

Dr. Charles T. Baylis, who has travelled from one end of the European battlefields to the other, spoke of some of his experiences in France and Belgium. He made an eloquent appeal for the further support of the Victory Liberty Loan by members of the Electrical League. Members of the League subscribed for $50,000 in bonds preceding and following the banquet.

TELEPHONE COMPANY GREETS EMPLOYES BACK FROM WAR.

407th Telegraph Battalion Welcomed by President Bethell of New York Telephone Co.

The 407th Telegraph Battalion, Signal Corps, composed of former employes of the New York Telephone Co., was mustered out of service May 3 at Camp Upton. On the same day the battalion was brought back to New York, tendered a lunch at the Holland House and dinner at the Commodore hotel by U. N. Bethell, president of the company.

In the evening the battalion was reviewed for the last time as a unit in the Seventh Regiment Armory by Brig.-Gen. C. McK. Saltzman of the Signal Corps, and Mr. Bethell made a brief speech. He said:

"We are glad you are back and we give you welcome, not only because of what you have done, but also because we need you. Your jobs are bright and burnished and waiting for you."

The regiment was recruited early in the war and was officially commended for establishing communication between Chaumont and Chatillon-sur-Seine.

At the close of the review the colors which had been presented to the battalion by fellow employes were returned. Miss Marjory Quigley received them with an appropriate speech. Major Mastin then called out each member of the command in turn and presented him with his discharge from the United States service.

PRACTICAL MEASUREMENTS OF DAYLIGHT IN MODERN FACTORIES.

E. G. Perrot Presents Test Results Before Philadelphia Section, I. E. S.

The last meeting of the Philadelphia Section, Illuminating Engineering Society, was held on April 23 in the Engineers' Club, Philadelphia, Pa. The paper of the evening, "Some Practical Measurement of Daylight in Modern Factory Buildings," was presented by E. G. Perrot. It dealt with the results obtained by him in a large number of measurements taken inside and outside of several buildings of various types. The effect was shown of time of day and year, of floor height, of interior construction and of other variable features on the illumination afforded by daylight in various parts of the building. The data obtained all show the great importance, when designing a building, of giving consideration to certain features if the most desirable results from daylight are to be obtained. Among the factors to be considered in this design are the effect on the workers and the critical point at which the loss of heat, due to increased window area, will exceed the gain due to increased natural illumination. The paper was illustrated with lantern slides. An interesting discussion followed its presentation.

Pacific Coast Section, N. E. L. A., Holds Big Convention

Third Annual Meeting Held in Conjunction with the Quarterly Meetings of Pacific Division, Electrical Supply Jobbers, and California Electrical Contractors and Dealers

WITH an attendance of over 500, the accomplishment of definite objectives and the determination of far-reaching policies for the future, the third annual convention of the Pacific Coast Section of the National Electric Light Association at Coronado Beach, California, April 30-May 2, may be regarded as the most successful yet held by this vigorous young section of the West. It was preceded by a two-day meeting of the Pacific Division, Electrical Supply Jobbers' Association, interspersed with meetings of California Electrical Contractors' and Dealers' Association and enlivened by presence of many on their way to the Westinghouse Jobber-Agents' meeting at Del Monte the following week. It was characterized by a spirit of harmony and co-ordination of effort among all branches of the industry.

Resolutions were adopted on several important matters. The engineering committee was instructed to make a study of the conservation of fuel oil by means of the electrical operation of steam railroads. The chairmen of the several technical committees of the National Association were requested to make their appointment of committee members in accordance with the recommendation of the chairman of the engineering committee of the Section. Disapproval was expressed of the proposed establishment of a standard of ethics by the U. S. Bureau of Standards purporting to outline methods of operation, the fixing of rates, etc. All branches of the industry were invited to co-operate in educating the public to understand the necessity of wall receptacles rather than fixture sockets for heating appliances. It was recommended that a Bureau of Public Relations be established under the direction of the Public Policy Committee to collect and disseminate information calculated to create and maintain a friendly public attitude toward the electric utilities. The financial support of the central stations was pledged to the California Co-operative Electrical Campaign for another year.

A. E. Wishon, San Joaquin Light & Power Co., was elected president for the ensuing year, E. R. Davis of the Southern California Edison Co. and Lee H. Newbert of the Pacific Gas & Electric Co., vice-presidents; A. H. Halloran of the *Journal of Electricity*, secretary, and J. F. Polland of the Sierra & San Francisco Power Co., treasurer. The new executive committee consists of R. S. Masson, Arizona Power Co., Geo. A. Campbell, Truckee River General Electric Co.; C. M. Einhart, Roswell (N. M.) Gas & Electric Co.; C. C. Hillis, Electric Appliance Co.; F. J. Somers, Century Electric Co.; E. O. Shreve, General Electric Co.; Wm. Baurhyte, Los Angeles Gas & Electric Co.; J. B. Black, Great Western Power Co.; Henry Bostwick, Pacific Gas & Electric Co.; S. M. Kennedy, Southern California Edison Co.; A. B. West, Southern Sierrra Power Co.; Samuel Kahn, Western States Gas & Electric Co.

The first session was called to order by President Samuel Kahn on Wednesday afternoon, April 30th, the meeting being opened with the singing of "America." William Clayton, manager of the Spreckels interests around San Diego cordially welcomed those in attendance. Appropriate response was made by Albert H. Elliott, secretary Pacific Division, Electrical Supply Jobbers' Association.

Samuel Kahn, in his presidential address stressed the necessity for a change in the present relation between the geographic section and the national association and the need for a more adequate provision for financing the section. (Subsequently the section unanimously adopted the suggestions of its executive committee relative to a de-centralization of the national association and a localization of effort.) He emphasized the value to the public and to the utilities of the fair-minded policy of the utility commissions throughout the section and recommended that their powers be extended to include the regulation of municipally-owned public utilities. He also urged education of the public as to the needs for more adequate legislation affecting public utility operation.

Secretary A. H. Halloran in his annual report summarized the progress of the Section during the past year, the report being amplified in those presented by the chairmen of the several standing committees.

Telegrams of regret because of their inability to attend were read from President W. F. Wells of the national association and Col. H. M. Byllesby. The national association was officially represented by R. S. McClelland, chairman of the Hydroelectric and Technical Section thereof.

A general session was convened Thursday afternoon for the purpose of listening to a masterly paper by S. M. Kennedy, general agent of the Southern California Edison Co.

In this paper on "The Man in the Street," Mr. Kennedy pointed out the necessity for utility companies cultivating the good will and confidence of the public. He explained that this could best be done by obtaining the viewpoint of the individual and showed the different angles from which the individual often judges the utility.

Strong endorsement of the sentiments expressed in Mr. Kennedy's paper were given by John A. Britton, R. H. Ballard, A. E. Wishon, T. E. Bibbins and Ed. Whaley.

The convention was officially brought to a close Friday afternoon with the reading of the Public Policy Committee Report by John A. Britton, the reading of resolutions and the election of officers.

Lavish entertainment was tendered all guests at the convention by means of auto trips, dancing and outdoor sports. The feature event was a visit to the army aviation field at North Island where an aviation circus was staged and opportunity given to investigate the equipment.

On Friday night a banquet was held, William

Clayton being the toastmaster, and E. O. Edgerton, president of the California Railroad Commission, the principal speaker.

Parallel sessions of the Engineering and of the Commercial Sections were held during Thursday morning and afternoon and on Friday afternoon.

Engineering Committee Sessions.

H. A. Barre, electrical engineer, Southern California Edison Co. and chairman of the Engineering Committee, presided at all meetings of this section.

The Insulation Committee's report was submitted. The committee consisted of John A. Koontz, chairman, Great Western Power Co., C. O. Poole, Sierra & San Francisco Power Co., and J. P. Jollyman, Pacific Gas & Electric Co. The salient features of this report are published elsewhere in this issue.

"Emergency Interchange of Power" was a paper read by G. R. Kenny. This paper described the arrangements by which the Southern California Edison Co., the Mount Whitney Power & Electric Co., and the San Joaquin Light & Power Co. overcame the impending power shortage due scarcity of water power, by pooling their loads and interconnecting their systems. This was at first done without any definite understanding as to settlement or restrictions as to energy interchange. A re-arrangement of switching apparatus was made, transformers were installed for permitting 15,000 kw. to be interchanged between the San Joaquin and Mount Whitney systems at Strathmore, Kern Station No. 1 was run at full capacity, while San Joaquin's Canyon station was cut loose from the 60-cycle system and operated at 50 cycles. A 5000-kw. frequency changer was installed at Magunden and the Big Creek 150,000-kv-a. transmission line was used for interconnection. The load dispatcher at Quesno had charge of the entire system, composed of three systems, with instructions to allow no water to flow to waste, and to save fuel everywhere by operating only what units were needed, and then at most efficient loads.

Power interchanged was paid for upon a basis of generating cost plus one half the saving resulting to the receiving company, with a number of clauses as to equipment used, uses, time of utilization, etc. The arrangement proved so satisfactory, so economical, that the interconnection is still in operation.

"Relay Protective Systems" was the title of a paper presented by G. E. Armstrong, and described in detail the relay protective system developed by the Southern California Edison Co. Climatic conditions are so favorable throughout the territory traversed by the company's lines that shutdowns are comparatively infrequent. While this fact has delayed the development of a complete and satisfactory protective scheme it also makes such a scheme the more imperative. Continuity of service is demanded by the customers. The cost of boilers, steam-making capacity and fuel consumption incident to stand-by service can all be reduced if the likelihood of service interruptions occurring can also be reduced. Interconnection and a complete and reliable system of relay protection accomplish this, and also lower to cost of patrolling lines, and energy losses in lines kept alive in readiness for emergency. Insulator failures will be reduced when proper relay protection is afforded; short-circuits lose a large part of their seriousness.

Choice of proper relay depends upon careful analysis of the system to be protected. A number of specific examples of what the Southern California Edison Co. has done in the way of relay protection, the construction of interconnected and duplicate lines, and mode of working out protective schemes are pointed out.

In "Converting a Steam Plant to Stand-by Operation" L. M. Klauber, San Diego Consolidated Gas & Electric Co. explained some of the problems that entered into the interconnection between the San Diego Gas & Electric Co. and the Southern California Edison Co. These consisted of changing the governor characteristics of the steam turbines to permit more equitable parallel operation with distant water turbines, a method of cooling steam-turbine blading while the machines float on the line ready to pick up load, an operating schedule for interchange of power between two systems through frequency-changers, methods of testing transmission lines so as to reduce line disturbances and protecting them while lightly loaded, boiler-room problems, regulation of the water supply, and manner of improving plant efficiency during stand-by service.

"The Use of Pulverized California Coal" was the topic of Chas. H. Delany. The advantages of burning pulverized coal, and the location of California coal fields and the analysis of their coals were taken up. A comparison of pulverized coal and oil as fuels was given. Various phases of erecting pulverized coal plants were discussed as were also the salient factors involved in burning powdered coal under boilers.

In the discussion R. J. C. Wood, Southern California Edison Co., emphasized importance of careful cost comparisons, and said the high sulphur content of California coals might lead to corrosion difficulties. Mr. Linden, Beckman & Linden, stated boiler efficiencies with pulverized coal should range from 78 to 82% instead of 75% as given by the author; further, the cost of pulverizing should vary between 35c and 55c, and not around $1 as stated by the author. Dry coal is vitally important if spontaneous combustion in storage bins is to be prevented. Cold or cool, but not hot, powdered coal can be stored. P. M. Downing, Pacific Gas & Electric Co., asked that more complete and extensive data be obtained, saying that such would be necessary before installations could go ahead. S. J. Lisberger, Pacific Gas & Electric Co., spoke of the high installation costs and difficulties to be overcome for pulverized fuel burning because of finding dry locations, overcoming arch and brick troubles, etc.

"Increasing Revenue by the Watthour Meter" was the theme of O. A. Knopp, who pointed out that although the induction watthour meter is both accurate and reliable, it often lags far behind the desired standard under the heavy overloads to which it is submitted. A curve straightener which permits the accurate recording of heavy loads by a small meter is advanced as the solution of the difficulty. This device is described and results obtained by the Pacific Gas & Electric Co. are given. This paper was discussed by F. S. Leach, Pacific Gas & Electric Co., C. M. Hoag, Southern Sierras Power Co., J. P. Jollyman of the Pacific Gas & Electric Co., H. A. Barre, Southern California Edison Co., and J. C. Abell of the Western States Gas & Electric Co.

"The Electric Welding Load" by John Hood, General Electric Co., discussed the field of application of electric welding, and the two general types of electric welding. The load-factor of resistance and arc welding, the metal electrode and the betterment of load-factor were pointed out. Mr. Hood's paper was accompanied by a demonstration of a welding outfit working on the constant-current principle. Samples of welds were shown. F. A. Anderson, U. S. Shipping Board, and W. B. Sawyer took part in the dis-

cussion, both telling of their personal experiences and opinions with electric welding, both emphasizing the importance of determining the proper combination of electrodes, character of material and its chemical and physical composition.

"Kilowatt-Hours per Barrel of Oil—What Does It Mean?" With this as his text, S. J. Lisberger, Pacific Gas & Electric Co. analyzed the meaning of "kilowatt-hours per barrel of oil" and pointed out the laxity so often accompanying its use. This is shown by the fact that the oil consumption per kilowatt-hour varies between 180 and 240 bbl., according to what is implied or understood. The influence of different classes of service supplied, the operation and performance of auxiliaries and the methods of operating in San Francisco were given.

"Automatic Induction Generator Plants," by E. A. Quinn, described the salient features of two small hydroelectric plants of the San Joquin Light & Power Co. that operate under heads which existed in the normal flow line of other plants located along the river. The plants are operated without attendants and represent a unique development brought about during the war. A further description of these plants will appear in the ELECTRICAL REVIEW at a later date.

"Some Notes on Suspension Insulator Design," by H. L. Garbutt, Westinghouse Electric & Manufacturing Co., was a paper that brought out considerable discussion. This paper discussed the theory of insulator design, failures that occur and the reasons therefor. Modifications in design were suggested, as were various tests.

S. J. Lisberger, Pacific Gas & Electric Co., presented the report of the Committee on Line Safety Code. A code has been prepared and would soon be approved by the California Railroad Commission. R. S. Ready, electrical engineer of the Commission, described the field inspection now being carried out throughout the entire state before approving the Code. He stated he considered such a code, when completed, as mor valuable than that issued by the Bureau of Standards because of the special local conditions dealt with by the former compared to the larger territory involved in the latter.

COMMERCIAL SESSIONS.

The first of the sessions under auspices of the Commercial Committee was opened Thursday morning with presentation of the paper on "The Proper Training of the Sales Personnel," by L. H. Newbert, commercial manager, Pacific Gas & Electric Co., San Francisco; this paper is abstracted at some length on other pages of this issue.

In the discussion R. H. Ballard, vice-president Southern California Edison Co., Los Angeles, emphasized the fact that the salesman is the first point of contact between the company and the consumer and that the impression left by him will have great weight. The salesman should see to it that the consumer is well taken care of from the minute the contract is signed and that the friendship he has created be maintained by courtesy from every department of the company. A salesman who knows his business cannot help being enthusiastic for the company and for the service as a whole. He it is who paves the way for the partnership between company and consumer.

John A. Britton, vice-president and general manager Pacific Gas & Electric Co., San Francisco, said that a salesman possessing all the characteristics mentioned by Mr. Newbert would not be a salesman but an executive. The primary qualification for a salesman is his ability to approach people and present the argument. Mr. Britton urged closer contact between the salesman and the executives. Every salesman should be known by the boss and should himself know the policies of the company, getting them from the boss; it makes no difference whether he is selling ranges, appliances or anything else. He urged the education of salesmen in the company's business and advocated visiting power plants, substations, warehouses, offices and garages for the purpose of thoroughly understanding the business.

K. E. VanKuran, Los Angeles manager, Westinghouse Electric & Manufacturing Co., took exception to the premise that the sales department is the all-important branch of any industry. Experience teaches, he said, that the all-important, dominating feature of any business, and particularly the electrical business of today, is service. Service can only be rendered through the proper co-ordinated effort of every person, section, division and department. It is necessary to apply the principal features of the sales personnel training to every department of the company and to every branch of the industry, with some additional features added for the specialized branches of the work. In the selection of salesmen, the first consideration should be the applicant's understanding of human nature. If we assure ourselves, first, by means of a proper analysis, that the prospective salesman has mastered the basic principles underlying this understanding of human nature, we need have no concern as to the matter of unquestionable integrity and honesty for this will follow through proper direction.

E. B. Criddle, general agent, Southern Sierras Power Co., Riverside, strongly advocated the selection of young men, molding their minds and training them in the policies of the company and thoroughly schooling them in the company's business. He declared the complexity of the business required an intensive system of training; one ill-considered act of an employe improperly trained will undo all the good work and work immeasurable harm to the company.

Glenn D. Smith, Ontario, laid particular emphasis on the need of salesmen familiarizing themselves with the policies of the company as promulgated by the management.

In presenting a paper on "How Can the Electrical Industry Assist the Architect in Serving His Clients," J. O. Case, General Electric Co., Los Angeles, stated that he had attempted to show the mutual advantages and benefits to be derived from close co-operation between the four branches of the industry—central station, manufacturer, contractor and dealer—on the one hand, and the consumer on the other. This paper will be abstracted in an early issue.

Henry Bostwick, Pacific Gas & Electric Co., San Francisco, gave hearty endorsement to the recommendations made by Mr. Case that a committee, consisting of the Advisory Committee of the California Electrical Co-operative Campaign be instructed to work out a definite plan of action to be approved by the Executive Committee of the Pacific Coast Section, N. E. L. A., the California Association of Electrical Contractors and Dealers and the California Electrical Supply Jobbers Association; the matter to be then taken up with the several local chapters of the American Institute of Architects for their endorsement. To this end Mr. Bostwick offered resolutions which were unanimously adopted. He also advocated propaganda for constructive advertising by central stations.

Capt. Robt. W. Brewer, consulting engineer, called attention to the fact that the architect is not an engi-

neer but that he does encroach on the latter's field from time to time. He cited the English custom in the preparation of specifications and submission of bids as an improvement over the American practice. In England, he said, when the electrical contractor is submitting a bid, he knows pretty closely what he is expected to bid on. The quantities and articles are stated clearly, so that all the contractors will bid on the same material. He strongly urged close co-operation between the contractors, architects and engineers.

Frederick D. Mills, National X-Ray Reflector Co., San Francisco, spoke of the great strides made by the manufacturers in getting electrical devices introduced into buildings. The architect must look to the manufacturer for the co-operation necessary to standardize the use of electrical devices. Further educational work must be along the lines of showing the owner and architect that contracts should not be awarded solely on price but upon the responsibility of the contractor to perform his duty in living up to the specifications. While the manufacturer's obligation ceases with the production of his materials, he is dependent upon the contractor to properly install the apparatus. A faulty installation usually reacts directly on the manufacturer.

R. E. Eltringham, of the California Industrial Accident Commission, stated that the Commission for two years has been studying the question of a standard code which will shortly be ready for submission. It is the present plan to combine this code with the Fire Underwriters' Code, making it fully representative of every industry affected. Mr. Eltringham urged the electrical industry to keep in close touch with the Commission in the framing of this code.

G. E. Arbogast, Los Angeles, manager F. E. Newbery Electric Co., stated that before the war the cost to the contractor-dealers in California of helping the architect through advertising amounted to $4000 or $5000 annually. With a revival of business, he estimates an annual expenditure for new building of $50,000,000, about 5% of which will be expended for electrical work. He believes this percentage could be doubled by proper co-operation with the architects and recommended the employment of two men whose duty it would be to keep in close touch with every architect in the state.

Electric Cooking and Heating.

The paper on "Progress of Electric Cooking and Heating," by B. M. Maddox, Mt. Whitney Power & Electric Co., Visalia, Cal., was presented in his absence by A. B. Wollaber, of San Bernardino. It will be summarized in an early issue.

Glenn D. Smith, Ontario, opened the discussion by giving the experience of his company in building up a cooking load with very gratifying results. John J. Gibson, Pittsburgh, Pa., through K. E. Van Kuran, presented discussion dealing with the question from the manufacturers' standpoint. He developed the necessity of the central station's realizing the necessity for pushing the electric range under a profitable rate. He also urged consideration of electric water heating in connection with the electric range.

P. H. Booth, vice-president, Edison Electric Appliance Co., Ontario, told of the progress that has been made in range construction during the past two years, particularly as regards the perfection of a satisfactory alloy for resistance wire. He emphasized the necessity of "selling the idea" of electric cooking and prophesied an early increase in range sales. As proof of the central-station realization of the value of the range load he stated that one company had found that a combined electric range and water heater is more profitable than a 10-hp. farm motor installation. Attention was also called to the importance of hotel, restaurant and bake-shop equipment. He agreed that electric water heating would be practically satisfactory if a suitable rate could be determined.

E. H. Richardson, Edison Electric Appliance Co., took the point of view that the progress to be made is largely a question of what we can give the consumers for their money, i.e., in quality and service at limited cost. He agreed with Mr. Maddox that the fewer models we can get along with, the lower the cost will be, both to the manufacturers and the dealers. The number of models which are finally agreed upon by the industry will become a very important factor in purchasing and handling ranges. To a considerable extent the troubles experienced with electric appliances, depends upon the judgment and general discretion of the user.

R. C. W. Libby, Simplex Electric & Heating Co., told some of the experience of the Boston Edison Co. with a flying squadron of 17 women in a range campaign and of heavy-duty ranges installed for the Government during the past two years.

In his address on "The Contractor-Dealer of Tomorrow" John C. Rendler, president of the Southern California Edison Co., treated each section separately. The future contractor, Mr. Rendler prophesied, will be an up-to-date business man who knows his work and that of his firm thoroughly. He will endeavor to provide in every residence, apartment or office building installation adequate facilities in the way of outlets, switches, etc., for the convenience of the consumer. By hard and consistent effort he will win back the business that has been lost by industrials doing their own work and will understand all modern power applications. The dealer, firmly established in a well located, clean, bright store will be recognized as a modern merchant. He will advertise, in conjunction with the other interests, to the limit of his financial condition and keep an accurate account of his business by means of good credit and accounting methods. When this is done his only competition will be from his competitor dealer, and then on an ethical basis. However, the good will of the consumer is essential to success and both the contractor and dealer should cultivate this now by honesty and fair dealing.

Discussion of this paper was opened by A. H. Halloran, *Journal of Electricity*, who presented a discussion prepared by Arthur Kempston, chief, San Francisco Department of Electricity, wherein argument was made that receptacle outlets be used instead of fixture sockets for electric heating appliances, or appliances separate from lighting circuits also being provided. A resolution recommending this was subsequently adopted.

K. E. Van Kuran told of present-day contractors who are living very close to the ideals indicated in the paper.

D. E. Harris, sales manager, Pacific States Electric Co., San Francisco, spoke of the work of the California Co-operative Campaign Committee and of the possibilities offered by the Pacific Coast Section, N. E. L. A., for closer co-operation between contractors, dealers and central-station men. According to Mr. Harris the contractors must continue to develop store and advertising methods and must arrange advertising to tie in with the advertising of the manufacturers.

M. A. DeLew frankly stated that it is right "up to the contractor-dealers themselves to keep abreast of the times and do things."

Carl Heilbronn, San Diego, waived aside all distinction between branches of the industry, maintaining there are not four branches but merely one big problem. The objective is the ultimate consumer, the man on the street. The problem must be looked at in a big, broad way with no disagreement or dissension. Mr. Heilbronn urged that the desires and demands of the public be studied and analyzed. Service is divided into two parts. First, pre-sale service, which comes before the sale is made. To this phase, almost exclusively, all thought and attention has been given for years. Second, post-sale service, which comes after the sale has been made. As an illustration of the latter, Mr. Heilbronn stated that his firm uses a trade-mark to show that it stands back of every article sold, and that the responsibility does not cease with the merchant after the sale has been made ,but continues indefinitely thereafter.

Selling and Sales Policies.

A paper on "Selling the Idea" was presented by H. L. Harper, Los Angeles manager, Western Electric Co. In this paper the advantage of selling the electrical idea or the result rather than the article itself was clearly pointed out. The customer does not buy the material which goes to make up the appliance or the process which operates it but rather he buys the service which it renders. Mr. Harper gave several instances where selling the idea had proven very successful after selling the apparatus had failed which illustrated the point very well.

T. E. Bibbins, Pacific States Electric Co., San Francisco, endorsed Mr. Harper's idea. When considered in its broadest application, it means an adoption of the broad principle "to serve." The public needs light and therefore the contractor-dealer, jobber, central-station manager, engineer and manufacturer's responsibility is to give him light and he is most successful whose imagination leads him to the most scientific and successful methods. Then the industries need power and finally and largest in possibilities, the home must be made more comfortable and the housewife's burdens lessened in all of which we accomplish it best when we "Sell the Idea."

R. M. Alvord, General Electric Co., San Francisco, stated that no real sales are made today unless they benefit the purchaser and give lasting satisfaction. The real salesman, therefore, looks for people who will really be benefited by his products. Let the salesman become imbued with the idea that the consumer will benefit and he will be enthusiastic over his work. Mr. Alvord strongly advocated the use of electric appliances by each salesman in his own home.

In closing the discussion, Mr. Harper called attention to the fact that a salesman seldom has to sell a person something he needs, but that while a person's needs are few his wants are many and it is his wants which open the field to the salesman.

"Appliance Sales Policies" was the title of a very interesting address by T. W. Simpson, western manager of the Federal Sign System (Electric). After a careful analysis of electric appliance possibilities from the standpoint of a skilled merchandiser of the department-store type, Mr. Simpson concluded that to such a man the possibilities of marketing large quantities of electrical appliances would not be very favorable under present conditions. This conclusion he stated would be correct except for a very important factor—the weight of authority of the central station.

This important principle he explained by three hypothetical cases: (1) The case of a central station conducting a retail department; (2) the case of a retail contractor-dealer in a city where the central station does not conduct a retail sales department; (3) the case of a contractor-dealer operating in towns where central stations conduct active merchandise selling. By these three illustrations, Mr. Simpson showed that the latter condition is the best for both the contractor-dealer and the central station, for the authority of the central station exercised on an ethical business basis stimulates buying from which the contractor-dealer benefits in many instances even more than the central station.

G. E. Arbogast gave warning against possible drifting back to former conditions when the merchandising was carried on by the central stations exclusively. He cited the excellent state of the industry in southern California as evidence justifying the merchandising of appliances by contractor-dealers.

P. H. Booth spoke along general lines in favor of Mr. Simpson's argument. A. M. Smith suggested the establishment of display under the supervision of the central station but arranged for appliance sales solely by the dealers. Mr. Simpson, in closing, stated that no backward step was contemplated in his recommendations, nor should such be permitted. He illustrated his argument by telling of a district whose limited appliance sale showing is directly attributable to the lack of sales effort by the central station.

W. L. Goodwin, General Electric Co., after pointing out the uniqueness of the electrical industry, proposed the ultimate establishment of a single organization embracing all the present branches of the industry. He urged a national campaign of publicity to this end along lines already followed by the Pacific Coast Section. The Goodwin plan was then explained in detail and how it fits in with this broader scheme.

ELECTRICITY USED EXTENSIVELY IN BUILDING SANTA FE TRAIL.

Power for All Road-Building Machinery Taken from Lines of Arkansas Valley Railway, Light & Power Co.

W. F. Raber, vice-president and general manager of the Arkansas Valley Railway, Light & Power Co., Pueblo, Ark., claims credit for his company as the first to supply electricity to be used exclusively in road building. The Pueblo *Chieftain* recently contained a long article concerning the work which is being done on the Santa Fe trail. The following paragraphs are quoted from the article:

"Electricity is now playing a very active part in road construction in Pueblo county. In addition to the motorized vehicles for hauling road building materials and the motorized machinery for grading and surfacing the roads, electricity is being used to drive the stationary machinery which prepares the materials for the road foundations and the surface. Perhaps no other county in the state is quite so favored with a combination of gravel, stone and electric current service as is Pueblo county. Especially is this the case between Pueblo and Fowler, where gravel beds abound every few miles, rock is within easy haul, and the high-tension electric wires of the Arkansas Valley Railway, Light & Power Co. follow along the Santa Fe Trail down the valley.

"And this electric current is being utilized in building this Santa Fe Trail into a highway boulevard from Pueblo to Fowler, or to the East Pueblo county line."

Commercial Practice

Proper Training of Central-Station Salesmen an Important Way of Getting Good Contact Between Utility and Public

THE PROPER TRAINING OF THE SALES PERSONNEL.

Abstract of Commercial Section Paper Presented at Pacific Coast Convention.

By Lee H. Newbert.

In every organization manufacturing a salable product the sales department is of the greatest importance, for no manufactory can exist unless a demand is created for its products. The degree of success attained is directly traceable to the department which disposes of this product or commodity.

The principle of commission regulation of utilities has become an established institution. When this present regime was first established more or less doubt was expressed as to what the result would be. The more skeptical advanced the theory that the utilities would suffer. It has developed, however, that the members and staff of a progressive railroad commission and the forward-looking men of the public generally are realizing more and more that the interests of the public and those of the utilities serving it are one and the same. The services of the utility salesmen in fostering and developing this idea are thus indispensable and quite as much of his time must be devoted to this duty as to the actual selling of electrical energy and appliances.

Whenever possible the prospective salesman should be selected from the ranks of the company because of his good record for faithful service and loyalty—two very essential characteristics. Unquestionable integrity and honesty are, however, the first requirements because the company's reputation with the public will depend very largely on that of its salesmen who quite frequently, in the eyes of the public, are the company, and it has been well said that an employe who will steal for you will also steal from you. Our candidate should also be neat in his personal dress and appearance and, to use a time-worn phrase, "Be able to meet people." In short, he must be a gentleman in the true sense of the word.

The electrical industry is inherently technical and it will be a great advantage if our prospect has at least some education in technical matters. This, however, is not absolutely essential and can be dispensed with if he has a good general education and more than average intelligence.

Women as salespeople can be used to excellent advantage. As canvassers and demonstrators in the sales of household appliances it is obvious that a woman can command more respect and attention in talking of the advantages in lightening housework and cooking by the use of such appliances and the proper methods of handling them to get the best results. The salesroom also offers a field for the profitable employment of women. The woman who shows that she understands electricity and its application is somewhat of a novelty. She, therefore, will command the admiration of the feminine trade.

The meat of the nut of salesmanship is satisfactory service. The article in all cases must fit the requirements. If anything goes wrong with articles of vital necessity, the effectiveness of the day's operation on the farm or in the home is greatly decreased, resulting in complaint and dissatisfaction.

It is essential that our salesman should be thoroughly schooled in the policies of the company and in the workings of its every department. He must be familiar with conditions and policies in the financial and executive department so that he may be able to direct his efforts to the additional load where the necessary extensions of service will be of such a kind as can be met from available finances. He must be thoroughly familiar with the policies of the credit department so that he can advise a customer what must be done to establish credit and be able to explain why.

A knowledge of the procedure in the engineering and construction department will make it possible for the salesman to see to it that the extensions which are most urgent will be taken care of in advance of those which may have been signed up at an earlier date but which are not so pressing. It will, also, enable him to advise the customer as to what kind of an installation and equipment will pass the inspection department.

Co-operation between the sales force and every other branch of the organization must be as perfect as obtainable, for the salesman must never make a promise unless he knows that the other departments can and will make good, or *vice versa.*

In addition to the closest possible contact and co-operation with their own organization our salesman must be thoroughly familiar with every detail connected with the appliance or service which he is delegated to sell. He should never "knock" a competitor or his goods. Truth and frankness pay in the long run. In time the customer will surely find out if he has been deceived, and if so, confidence in both the salesman and his company will be destroyed. It devolves upon the salesman to thoroughly understand the principles of rate-making and to be able to pick out the most economical rate for his customer's conditions and to work out the same to his complete satisfaction and understanding, if possible.

Having decided on the personnel of our sales force and the broad lines along which they are to be trained, we now come to the main subject in hand—how to train them and, glancing back over the prescribed essentials, we must admit we have set out upon a man-sized job. However, it has been done with more or less success and we must therefore not despair at the outset.

First we must offer him a salary commensurate with his position, which you will remember is in the most important department of the organization. We do not ask him to work for a salary that the meter setter would not consider, for we remember that this man is going to make work for the meter setter. We also bear in mind that it will cost something to edu-

cate this salesman to a point where he is of real worth to the company and we realize that the compensation must be such as to attract a competent and aggressive man and keep him loyal.

Among several of the larger eastern utilities that serve vast populations, the salesman and other representatives who come in contact with the public have first to pass through a school of instruction in which they are thoroughly equipped with the necessary knowledge and information for their particular lines of work before beginning to sell.

When a prospective salesman has been selected he is schooled in the policies of the company, shown the methods of operation of the different departments and finally drilled in all the matters necessary for a complete understanding of the service or commodity he is expected to sell. When he has successfully passed through this school of instruction he is given the position of a salesman and not before. This, of course, is the ideal way of making salesmen; but to the most of us who are at this time so vitally interested in the proper development of our sales forces, this plan is beyond our reach and we have of necessity to consider more immediate result-producing possibilities.

Here the N. E. L. A. has come to our aid with a series of most admirable correspondence courses. These courses are carefully prepared by specialists and edited by committees composed of men of long experience in the electric utility business. The tuition fees include all necessary books and special material.

No two companies find their needs and possibilities exactly the same. Whatever training method we adopt, we can say without reservation that no matter what the size and extent of our organization, it must have a good, healthy morale if it is to function properly. In other words, we must have a "happy family."

It is possible to prepare at least a set of general rules for the salesman's guidance and to furnish answers to a list of the more probable questions the salesman will be asked. There is, after all, only one best way to handle each different situation and if the salesman is schooled in several hypothetical cases his intelligence can be depended upon to select the best course of procedure along the lines in which he has been instructed.

Such rules and suggestions can be amplified and kept up to date by the establishment of a mimeographed loose-leaf bulletin recording all changes in rules or policy. This bulletin could easily be made of great educational value by publishing an occasional sales-talk of special merit, or a talk by the general manager or heads of departments. In this manner the best thoughts of the organization may be collected for the use of present and future employes.

As an example, when the so-called emergency increases in electric rates were recently effected, this matter should have been fully covered by a bulletin that the salesman could have read and from which he could have gathered data so that he could state with conviction that loan capital, labor, fuel, taxes and material had all advanced and he could have told the consumer in just what proportion.

Of course, our salesmen should be instructed under no circumstances to start an argument or even waste time with a theorist, but when challenged by Mr. Average Citizen he should be sufficiently informed to protect the company and preserve his dignity. The salesman who cannot answer reasonable questions makes himself contemptible in the eyes of the customer and surely does his company an injury.

Our man should be taught to be a propagandist. He should be able, through the instructions he is receiving day by day to defend intelligently the policy of his company.

He should know that the utility business is being placed on a service-at-cost basis and that any citizen with a grievance can readily get a hearing. He should be told that public service companies are owned by hundreds of thousands of investors. He should know what the Railroad Commission does and can do. All this will result in a better knowledge of the business by the employe and if he is a good propagandist the result will be also a better understanding between the consumer and the company.

When there are enough salesmen employed to warrant its success, there is nothing to stimulate interest like get-together meetings and conventions. Here there can be an interchanging of ideas that will result in nothing but benefit.

The sales forces should be brought into closer contact with the managing heads of our utilities. The salesman should be made to feel the responsibility resting upon him and he cannot do so unless he feels that he has the confidence of his chiefs. It is necessary to inject a little enthusiasm into a sales force from time to time and, what better method is there than a talk with the "big boss"? As a matter of fact, it is essential that the salesman know the hobbies and the dreams of the "big boss." This would give him an understanding of present policies not clear to him but for which, considered in connection with future operations and plans, the necessity will become apparent.

Much information can be gained from the trade journals and the salesman should be encouraged to read them regularly. Some method should be taken to ascertain the amount of knowledge our salesman is acquiring. Probably the most simple way to do this is to assign him the task of preparing an article to be read before the other men, possibly offering a prize for the best paper.

There is much to be taught our men of which no mention has been made and there are many things of which, perhaps, we have never thought that they may be able to teach us. We have but barely touched upon the many ways in which a salesman can be of great value to his company outside of the strict limits of signing contracts.

He can also make himself invaluable in adjusting complaints and disputes in regard to bills or collections, or any trouble connected with the company's service, more readily than could the employe of some other department who has not established the friendly relations with the customer that to the salesman are essential to getting business as well as to retain it.

APPRECIATION OF UTILITY EFFICIENCY.

That the increased efficiency in all departments of the Pennsylvania Utilities Co., of Easton, Pa., is appreciated by the public is evidenced by the editorial notice appearing in the *Sunday Call,* one of the city's leading newspapers. It was occasioned by the prompt manner in which the company replaced a worn out pole to which the city council had called attention.

"This immediate response by the power company," says the *Sunday Call,* "when its attention was called to needed repairs, is worthy of comment and commendation. It shows that it is no difficult task for city authorities and public service corporations to work in conjunction. We should applaud the power company for its prompt response."

Operating Practice

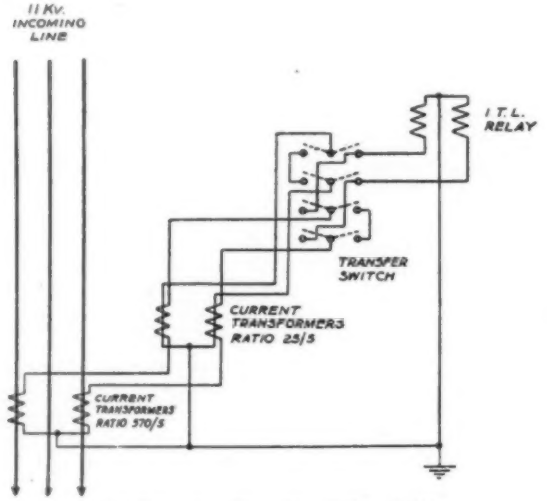
Overload Relay Control — Determining Safe Distributing-Transformer Loading — Adjustable Crossarm Spacer

VARIABLE SETTING FOR OVERLOAD RELAYS.

Simple Expedient Adopted by San Diego Gas & Electric Company for Testing Line.

The San Diego Consolidated Gas & Electric Co. is interconnected with the Southern California Edison Co.'s system by a 60,000-volt, 50-cycle transmission line 30 miles in length, from Katella Substation to San Juan Capistrano, and a 70,000-volt, 60-cycle line 76 miles long that connects San Juan Capistrano to San Diego. These two lines connect through a 6250-kv-a. frequency-changer set at Capistrano.

At the San Diego end of the lines the step-down transformer bank has a rating of 6000 kv-a. and transforms the voltage from 66,000 to 12,000 volts. Before the tie-in of the two systems a steam plant at San Diego supplied a close-in distributing system at 2400 volts and outlying districts at 11,000 volts. The 2400-volt buses are connected to the 11,000-volt buses through three transformer banks rated at 6000 kv-a., there thus being two transformations interposed between the local generators at San Diego and the transmission line. The capacity at San Diego is rated at 11,750 kw.



Connection for Changing Relay Setting.

One of the problems encountered was in connection with testing the transmission lines for grounds, short circuits, etc., before cutting in a line after repairs or trouble. The in-coming circuit-breakers controlling the lines being set to operate and trip out the breakers at 12,000 kw. would result in a severe jar to the steam plant at San Diego should the line be cut in on a short-circuit. To overcome this difficulty a double-throw transfer switch has been installed which by the use of two additional current transformers permit the setting of the overload relays to be quickly and easily changed. The test or light-load setting chosen is one-fifth that of the normal setting. The light-load setting is used not only when testing the transmission line, but at times when no energy is being transmitted between the two systems. The scheme is illustrated in the accompanying diagram.

DETERMINATION OF SAFE LOADING OF DISTRIBUTING TRANSFORMERS.

Ammeter Is Superior to Thermometer, While Latter Aids Former.

By B. M. Smith.

Two factors limit the permissible loading of a transformer, namely, maximum temperature attained and regulation. The former decides the life and safety of the transformer, the latter the revenue produced and the quality of service rendered. As the investment in a transformer produces the greatest return when the transformer is fully loaded all the time, it is the aim of central-station companies to keep their transformers operating at the highest load-factors and as near rating as possible.

Under the title, "Method of Determining Proper Loading of Distributing Transformers," an article appeared in the Electrical Review of April 5 in which was advocated the use of maximum registering thermometers instead of the split-ring current transformer and ammeter. While the registering thermometer is a valuable adjunct to the work of determining the loading of transformers, it is the opinion of many engineers that the thermometer should be used only in conjunction with the ammeter and not instead of it.

So long as the temperature remains within safe limits it does not matter what that temperature actually is. So long as the amperage does not exceed the safe limits, based upon maximum temperature, the temperature will be within safe limits also. The engineer cares very much what the amperage is, because it is the deciding factor in determining whether the right transformer capacity has been chosen or not. While temperature decides whether the transformer is safe from damage or destruction, amperage is the indicator of correctness of unit for the job and safety of the unit. Knowing the amperage has the further advantage that the transformer regulation can be readily estimated from the knowledge of power-factor upon which, in turn, the service rendered and revenue obtained depend.

In keeping transformer records, transformer rating in amperes is the most useful basis, since it is kilovolt-amperes and not kilowatts that determines output, hence, heating. Measuring transformer temperatures instead of ampere load upsets the records and because the temperature rise varies with atmospheric conditions, immediately places transformer rating upon a

variable basis. Every company should determine the safe current-carrying capacity of its transformers (the temperature rise of all makes of transformers should be determined) by measuring amperage and temperature. With these data as a basis it is not a difficult matter to base opinions as to safe loading upon data obtained in the field from the split-ring current transformer and ammeter indications.

Measuring distributing transformer temperatures outdoors is open to many objections. Temperature tests, unless made by exploring coils or thermocouples especially placed in the transformers before they are installed are liable to error, hence a wrong feeling of security may be obtained. On the other hand, transformer capacity may be curtailed or the transformer subjected to excessive overloads for the same reason. It is almost impossible to be sure that the thermometer registers the highest internal transformer temperature or to what extent it errs. Knowing the temperature gradient from the "hot spot" to the location where the thermometer is located overcomes this objection.

However, allowing for errors, or possible errors, due to placing the thermometer correctly and ability to interpret the readings intelligent, to what extent is there any assurance that the internal temperatures recorded are a true indication of transformer performance? To cite one simple and obvious example: Suppose a transformer serves a badly unbalanced three-wire secondary network, the unbalance being due to unequal loading or to a ground on one side of the Edison system. The effect of this is to load up the coils or windings of one-half of the transformer in excess of the other half. For the sake of example, imagine that the one set of coils carries full load, the other set of coils no load. Under these circumstances the temperature registered by the registering thermometer will be low; in fact that approaching half load on the transformer. Were an ammeter employed instead of a thermometer, the unbalanced condition would have been instantly brought to light and a remedy found. Data based upon temperature readings in the above instance would obviously be unreliable in the extreme.

Providing thermometer readings can be accurately obtained and intelligently interpreted when obtained, it must be borne in mind that opening a distributing transformer case while the unit is installed upon a pole is not free from risk to apparatus as well as men. The work cannot be done safely during unfavorable weather because of the likelihood of electric shock and the probability of moisture entering the transformer case. When the transformer cover has been removed and replaced after the tests are finished, the oily dust seal is broken, and conditions are more favorable for moisture to enter.

The split-ring current transformer and recording ammeter afford the most reliable data as to transformer loading, and also the most convenient manner of obtaining this data. The results obtained tell directly what it is desired to know, namely, whether load must be taken off or whether additional load can be placed upon a transformer. If something has gone wrong on the secondary network, the ammeter immediately brings the fact to light. The ammeter readings are obvious, straightforward and direct. Ammeter readings show whether circuits are balanced, the diversity and the load-factor. Readings can be obtained without danger to apparatus or men, without interrupting service or climbing a pole in some cases.

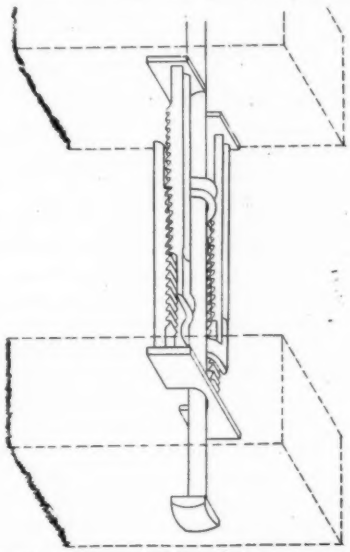
If the temperature attained by the various types and makes of transformers is known for different external temperatures and humidities (and it is the writer's opinion that few companies have made such tests) it is not a difficult matter to estimate the safe loading of distributing transformers when installed. The above tests are tests for the engineer and not for the lineman to make, however.

Determinations of amperage are more easily obtained than temperature readings. And the data is worth more. Nevertheless, a knowledge of temperature in conjunction with current is valuable. Where one or the other only can be had, current is the more preferable.

ADJUSTABLE SPACER FOR CROSSARMS.

The Northern States Power Co. has gone a long way toward standardized transmission-line construction. This company's transmission and distribution lines cover a considerable part of Minnesota and operate at a number of different voltages, depending upon present and future loads, etc.

In order to permit a transmission line that has been built economically for present needs to permit of modification as the load grows by increasing the voltage, one of the practices of the company is to employ a crossarm spacer.



Spacer Employed by Northern States Power Co. for Adjusting Distance Between Crossarms of Transmission Lines.

The spacer, which is shown in the accompanying illustration, has been designed by S. B. Hood, superintendent of distribution, Northern States Power Co., for use on double-arm poles. This spacer is known throughout the company as the saw-tooth spacer. It consists of two pieces of malleable cast-iron, exactly alike and 3½ in. in width. The saw-like teeth of one piece engages the teeth of the other piece and in this way makes the length of the spacer a variable quantity. The through bolt, shown in the accompanying illustration, passes through straps on both pieces of the spacer and holds the teeth engaged so that they cannot slip or disengage. When the nut is tightened both arms and spacer are held rigidly together in place by the through bolt. The through bolt of itself suffices, hence no other clamps or bolts have to be bothered with and changing the distance between crossarms within the range of the spacer becomes a simple matter that can be quickly accomplished with safety.

Contracting-Construction

Electrical Key Now Ready—Flexible Switchboard Design—Comstock Denies Rumor—Long Island Contractors' Exhibit

LATEST EDITION OF ELECTRICAL KEY NOW READY.

Pamphlet Affords Convenient Method of Communication Between Electrical Inspectors and Contractors.

The latest, 1919, edition of the Electrical Key has just been completed and is now ready for distribution. The object of the Key is to afford a ready means of communication from inspection departments having jurisdiction to the electrical contractor making the installation. It is published shortly after each edition of the National Electrical Code by Washington Devereux, Bullitt building, Philadelphia, Pa., president of the National Association of Electrical Inspectors.

In the Key the various recommendations which experience has shown to be the requirements by inspection bureaus to correct installations not in harmony with the Code and some municipal requirements, are compiled by numbered items and grouped so that they can be easily located. In this way the inspector is able to notify the contractor of the work necessary to correct the conditions found in an installation by indicating on a postcard or form the numbers corresponding to these conditions. The convenience and efficiency of such a method can easily be seen.

The pamphlet also contains numerous tables and formulas, resuscitation and safety rules, etc., and some illustrations showing approved methods of grounding. The latter part of the Key is devoted to a guide to changes in the 1918 edition of the National Electrical Code. These changes were published in the Dec. 7 and 14, 1918, issues of the ELECTRICAL REVIEW.

Copies of the Electrical Key can be obtained from Mr. Devereux for 35 cents.

USING SAFETY SWITCHES TO ADD FLEXIBILITY TO SWITCHBOARDS.

Two Installations in Canadian Factories Use This Type of Apparatus to Good Advantage.

In the majority of factories, office and loft buildings it is almost impossible for the electrical contractor or the customer to determine at the time the installation is made what the ultimate power requirements will be. For this reason flexibility is often a matter of prime importance in the design of switchboards for such buildings. In the accompanying illustrations are shown two boards which satisfy this demand very nicely. They are installed in two Canadian plants which were engaged in war work and are composed of individual safety inclosed switches mounted on an iron framework. In addition to obtaining the required flexibility, these boards are safer to operate than the open type switchboard and effect a considerable saving in floor space for, as no live parts are exposed, the necessary clearance space is not required. Detroit, square "D" safety inclosed switches, incorporating the latest safety features, were used in both cases.

The switchboard shown in Fig. 1 was installed in a forge shop. In addition to the regular lighting and power equipment, there was installed in this plant a number of bench-type, induction, single-phase electric furnaces, used for tempering small tools. These furnaces were manufactured by the Canadian Hoskins Co. Three services were brought in in conduit from

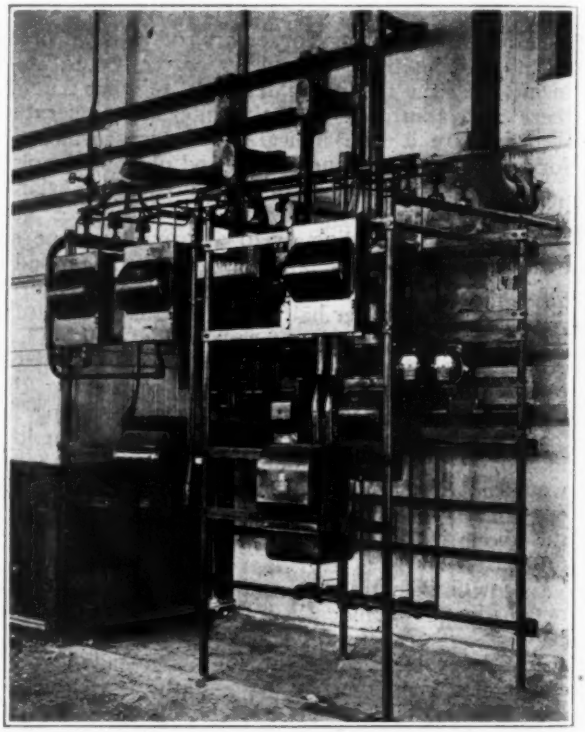


Fig. 1.—Flexible Safety Switchboard Installed in Canadian Forge Shop.

the transformer bank, which was installed on a concrete base on the exterior of the building provided with a suitable inclosure. The incoming services contained one three-phase, 440-volt, 66⅔-cycle line for power, and two single-phase, 110-220 volt, 66⅔ cycle lines for lighting and the other for heating. The object in using two separate services for lighting and heating was for the purpose of balancing the load on the primary service which was two-phase, 2200-volt. Each service was metered separately, as shown in the illustration.

The switchboard is arranged in two sections, one in front and the other in the back. On the back section are mounted the main line switches and meters. On the front section the control switches for four motors are mounted. Three small motors are controlled directly by knife switches. The fourth motor is controlled by a type "K" Canadian Westinghouse Co.

autostarter with overload relays, inclosed in the starter. This type of compensator makes a very compact installation and affords adequate protection for the motor.

This installation is particularly suitable for this type of building as there is a great amount of dust and dirt present at all times. All live parts of the apparatus were protected and inclosed to prevent any workmen while handling metal coming in contact with any of the electrical apparatus, which is a very important feature.

The board shown in Fig. 2 was installed in a factory where a great amount of power was used to supply small motors for a large number of individual motor-driven machines. As in the other installation, three services were used, one three-phase, 440-volt, 66⅔-cycle service for power and two three-wire, single-phase, 110-220-volt for lighting and heating. Separate feeders were installed for each floor protected

Fig. 2.—Another Switchboard Composed of Safety Switches.

by individual switches and fuses. All of the busbars are mounted on insulators at the rear of the rack. This equipment was installed to replace the wooden metal-lined cabinet which can be seen at the rear of the rack mounted on the wall. The wiring was installed in exposed conduit systems and the risers for each floor were installed so that the capacity for any floor could be doubled by duplicating the equipment.

COMSTOCK COMPANY NOT TO ENTER JOBBING FIELD.

Recent Letter from Head of Firm to Mr. Goodwin Contradicts Rumor.

The following letter was recently received by W. L. Goodwin, of the General Electric Co., Schenectady, N. Y., author of the Goodwin plan for electrical contractors and dealers, from L. K. Comstock of the L. K. Comstock Co., New York and Chicago, one of the largest electrical contracting firms in the country. From the contents of this letter it is evident that the rumor which has been broadcast in electrical fields to the effect that the Comstock company is about to engage in the jobbing business is without foundation. In order to offset any momentum that this rumor has been given it has been deemed advisable to contradict it publicly.

The letter is as follows:

Mr. W. L. Goodwin,
care General Electric Co.,
120 Broadway, New York City.

Dear Sir: In response to your letter of April 16 concerning the rumor that we are contemplating entering the jobbing field, I desire to say, by way of reply, that we have never contemplated such action and do not have it now in contemplation. At the present time we cannot see the slightest reason for considering such a move.

If this information serves your purpose, you are at liberty to use it in any manner you see fit.

Yours very truly,
L. K. Comstock & Co.,
(Signed) L. K. Comstock.

CONTRACTOR'S EXHIBIT FEATURE OF BROOKLYN INDUSTRIAL SHOW.

Largest Display at Brooklyn Engineers' Club Show Arranged by Long Island Contractors.

The industrial exhibition arranged and conducted by the Brooklyn Engineers' Club at the 23rd Regiment Armory, Brooklyn, closed Saturday night, May 3, after a most successful week. The exhibition consisted of a showing of goods manufactured largely by local industrial establishments although several outside manufacturers of nationally known products were also represented. That a great variety of industries was represented at the exhibition is indicated by the fact that the entire floor space of the armory, 60,000 sq. ft., was allotted to manufacturers and industrial concerns. The exhibition booths were arranged in groups so that the articles manufactured by similar industries were situated together.

The largest and one of the most interesting displays of a single group of industries was that arranged by the Long Island Electrical Contractor-Dealers' Association under the leadership of Louis Kalischer, a prominent Brooklyn contractor. This display, which occupied 2500 sq. ft., consisted of exhibits by the members of the Association and those of several large manufacturers of electrical goods in different parts of the country. The electrical exhibit was unusually attractive not only because of its size and the large number of new and improved products that were displayed, but also because of the fact that the apparatus on display was kept in operation for the purpose of demonstrating its usefulness. This operating feature also prevailed in nearly all of the machinery displays at the exhibition.

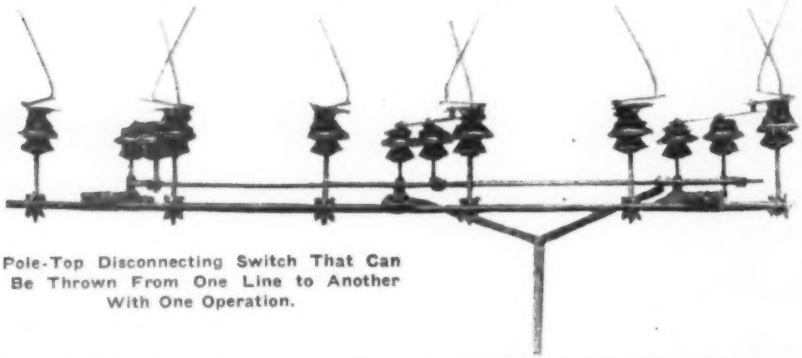
The artistic feature of the exhibit was the exhibition of original drawings arranged in the section allotted to the Brooklyn architects. These drawings represented plans and elevations of monumental buildings which have been built by Brooklyn architects. An open meeting of the Engineers' Club was held Thursday evening for the benefit of visiting engineers at which several interesting addresses were delivered.

New Appliances

Pole-Top Disconnects—Electric Lead-Burning Set—Busbar Bender—Small Air Compressors—Furnace Transformers

Double-Throw Pole-Top Disconnecting Switches.

Double-throw pole-top disconnecting switches are usually constructed so that they virtually consist of two single-throw switches. One insulator carrying two sets of contacts is common to each switch. This arrangement requires two separate switching operations in order to transfer from one line to the other.



Pole-Top Disconnecting Switch That Can Be Thrown From One Line to Another With One Operation.

The Electrical Engineers Equipment Co., Chicago, has developed a type of double-throw switch which accomplishes this change-over in one complete operation. Provision is also made whereby the feeder can be disconnected from both lines and the switch blades remain in the neutral or open position. This is also accomplished by a single operation. The mechanism is arranged to lock in all three positions.

The switch, which is shown in the accompanying illustration, is constructed by using a standard type, No. 400, single-break switch, manufactured by the same company, and adding a cross pipe which carries three additional insulators each equipped with jaw contacts. An upward thrust or a downward pull on the operating pole, which is connected to a toggle mechanism, throws the switch to any position.

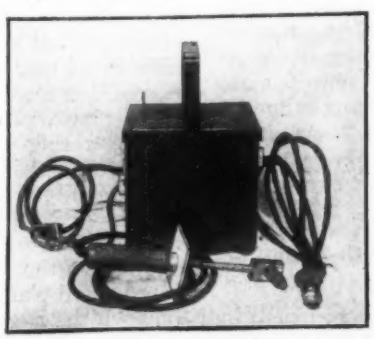
Providing a pipe base makes the switch very easy to install. It is not necessary to adhere to any fixed drilling dimensions, as is the case when a channel-iron base is used. The insulators to which the lines are attached are rigid and do not swing or twist. Each switch is equipped with arcing horns and sleet hoods.

Simple Electric Lead-Burning Outfit for Storage-Battery Work.

In a storage-battery service station or garage handling simple repair work on lead storage batteries it is necessary to disassemble and reassemble not only batteries or groups of cells but individual cells. This requires some means for loosening the lead connectors between cells and the plates from the terminal straps in the cell and then reconnecting them again. All these connections must be made of lead solidly welded or "burned" together, not soldered because the acid electrolyte would destroy the soldered joints.

For this purpose it has been customary to use special lead-burning outfits consisting essentially of an oxygen-hydrogen flame or substitute therefor; sometimes illuminating gas has been used in place of hydrogen, oxygen being employed with it; sometimes compressed air has been used in place of oxygen, hydrogen being used as the burning gas. In any case, hydrogen, oxygen, or both, were required, depending on the extent of the work done. In such cases of lead-burning work, not only is the equipment cumbersome and rather dangerous on account of the possibility of violent explosion, but it requires much skill to operate properly.

These disadvantages are overcome in an electric lead-burning outfit placed on the market by the Spence Electric Co., 136 Liberty street, New York City. As illustrated, it is very simple and compact. It consists of a step-down transformer with primary connectible to any alternating-current, 110-volt, lighting outlet, like a bell-ringing transformer. The secondary, or low-voltage, terminals are solidly connected from the secondary winding, one to a spring clip that is connected to the cell structure and the other an electrode mounted on a suitably shielded handle. This electrode is used somewhat as in electric welding. Relatively little skill is required. The heat is controlled by varying the pressure on the electrode's point of contact. There are no gas fumes to contend with. The work, although slower than when a skilled operator uses an oxygen-hydrogen flame, is under perfect control and no damage can be done. The power consumption averages about 300 watts.



Spence Electric Lead-Burning Set Complete—A Compact and Easily Operated Outfit.

The entire outfit is quite compact, with dimensions of the transformer only 8 by 7 in. The weight complete is about 30 lb. Spare electrode parts and operator's glasses are furnished with the set. This outfit is a thoroughly practical one for places, like garages, etc., where light lead-burning work is done occasionally.

Convenient Busbar Bender for Smaller Size Bars.

Cabinet-box builders, construction men and others who have been bending up considerable amounts of small size copper bars and strap iron for various purposes have spent much time and good thought in attempting to make up fixtures and devices for doing this work. The usual result has been that after they had spent many dollars in making this device it was satisfactory for only one size of bar and one class of work, and was not thoroughly adaptable to the many sorts of bending that are necessary in a year's work.

The General Devices & Fittings Co., Chicago, Ill., has developed a universal bending machine, with a capacity up to 2 by ¼ in. copper bars, that will be invaluable to anyone bending small copper or iron bars. One adjustment

Handy Bender for Small Busbars and Strap Irons.

only is necessary, and that is setting the nose plate to the thickness of bar being used, after which any number of duplicate bends can be made with great speed.

The machine will bend a ¾-in. U or offset without disfiguring the copper in any way. This can be done any place on a long bar, and is a valuable feature in cabinet-box work. A spring-back adjustment is provided so that a true 90° bend is effected.

This bender can be bolted to the work bench or carried around from job to job and set up by the use of a couple of clamps and is operated from either side as found desirable, by using a wrench handle on the square boss supplied on both ends of the bending trunnion.

The bed of the machine is cast steel and is supplied with a bending trunnion and nose plate of hardened tool steel. The machine is furnished in gray enamel with all adjustment bolts and nuts copper-plated.

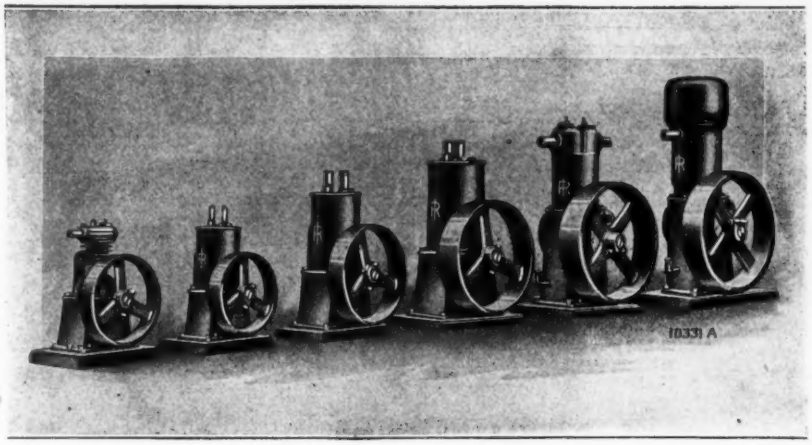
The General Devices & Fittings Co. also builds bending machines with capacities up to 8 in. by ½ in. copper bars.

Small Air Compressors Especially Suited to Motor Drive Through Belt.

In the emergency at the outbreak of the war there was a sudden call for a large number of small air compressors for service where reliability was imperative, to meet which the Ingersoll-Rand Co.'s offer to produce for immediate use the "Imperial Fourteen" compressors, which it had just completed testing out and had adopted as the new standard small compressor type, was accepted. The field performance of these built-on-hurry-order machines was critically watched, but after a year's service their record was clear. These little machines have now been placed on the general market. There are four sizes and the capacity range runs from 3 to 45 cu. ft. per min. at pressures to 100 lb. per sq. in. The small compressors can, however, be used for pressure requirements up to 200 lb. per sq. in., the horsepower needed being, of course, slightly increased. They are single-acting machines of the vertical type built for belt drive. Where driven from line-shaft, tight and loose pulleys are supplied; where the use of independent motor is planned, as is now very common, they are ordinarily furnished as a unit complete with motor, endless belt and short drive attachment. In the latter case a hardwood baseplate is included with the standard equipments.

The machines are so well balanced as to operate satisfactorily if bolted to any solid flooring, but where permanency of installation is desired the building of a concrete foundation is advocated. The smallest size is built with ribbed cylinder for air cooling where the service is intermittent, and with water-cooled cylinder of the reservoir type for continuous operation. Larger machines are water-cooled only, employing the reservoir jacket system except that, in the case of the largest size, a closed jacket for connection to a pressure circulating system is optional. In this connection it is worth noting that the reservoir cylinder design affords unusually ample water capacity and that both cylinder barrel and head are cooled. The manufacturer states that a single filling of the water space will suffice for a 10-hour day's run.

It is pointed out, however, that these little units were designed to meet an exacting efficiency test and that, while simplicity was sought, efficiency was the outstanding requirement. They are manufactured by the Ingersoll-Rand Co., 11 Broadway, New York City.



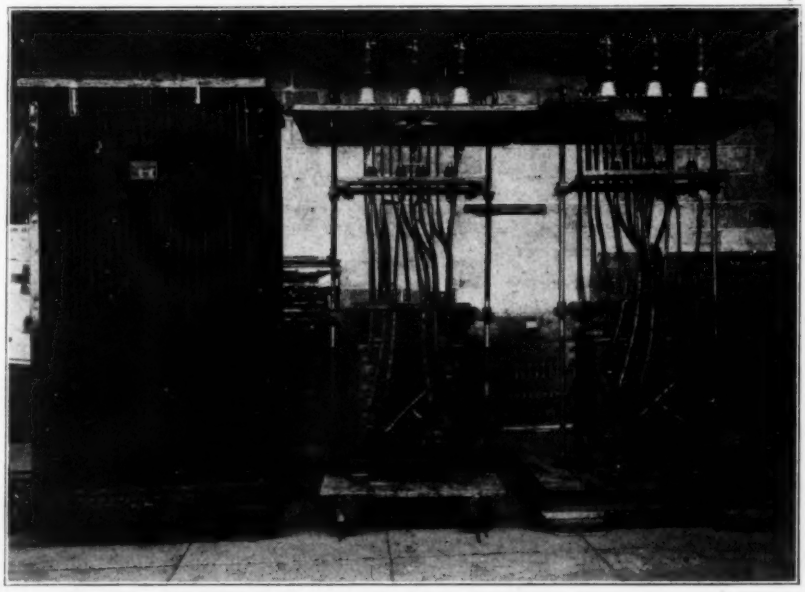
Four Sizes of "Imperial Fourteen" Vertical Air Compressors—The Smallest Size Is Made Air-Cooled and Also Water-Cooled; the Largest Size Is Built With Reservoir Water Jacket and With Jacket for Circulating Water.

Single-Phase Transformers for Electric Furnace Service.

The electric furnace owes its growing acceptance as a desirable medium, both for heat-treating steel and melting non-ferrous metals, chiefly to the more exacting control that it offers over furnace conditions. To supply an important link in the control equipment of its Baily electric furnace, the Electric Furnace Co., Alliance, Ohio, is building special transformers.

These core-type transformers are of 400-kv-a. capacity, and the high-tension side, fitted with the usual voltage taps, is wound for 22,000 volts. The low-tension side is fitted with 10 special voltage taps to meet the particular voltage requirements of the furnace. Each transformer is single-phase, and for small furnaces, requiring 100 kw. or less, one transformer is sufficient. Three-phase power is taken care of by two transformers arranged with a Scott connection. By means of the special low-tension voltage taps, any desired current input may be delivered to the furnace through the selective oil-break switches that are a part of each installation. With the furnace current under control, any furnace temperatures may be steadily maintained.

The transformers illustrated have just been shipped to the Braeburn Steel Co., Braeburn, Pa., as an accessory of a large 800-kw. continuous recuperative Baily electric furnace that will be used to anneal alloy-steel bars and wire. This special alloy requires a slow heating, lengthy soaking at maximum temperature, and cooling at a slow rate for the first 200 to 300 degrees. This installation is of special interest for, although the usual annealing-box covers are not used, scaling is entirely eliminated by this new method of electric annealing.



Special Transformers With Numerous Primary and Secondary Voltage Taps for Obtaining Close Control of Electric Furnaces.

Trade Activities

Samson Fire Alarm Systems Approved — Wm. J. Norton Opens New York Office — Valuable Literature Issued

W. B. Richards & Co., formerly Gunn, Richards & Co., engineers and accountants, have removed to new offices in the Empire building, 71 Broadway, New York City.

Sessions Engineering Co., consulting engineer, of Chicago, who specializes on power station construction and industrial power requirements, has moved its main office to 22 West Monroe street.

Blaw-Knox Co., Pittsburgh, manufacturer of steel products, has appointed J. E. Mason manager of field sales. In this capacity Mr. Mason will supervise the operation of a wide sales agency plan throughout the country. He is a graduate of the civil engineering school of Purdue University.

Doehler Die-Casting Co., Brooklyn, N. Y., has just gotten out a booklet, "Do-Di Finished Brass Castings," containing an illustrated description of its die castings, the process for which the company has been perfected within the past two years, and which it is now producing commercially on a large scale. In addition, the booklet contains numerous testimonials from users of "Do-Di" castings and records of tests made by various companies.

Samson Electric Co., Canton, Mass., manufacturer of the Samson fire alarm systems, announces that its systems have recently secured the approval of the National Board of Fire Underwriters. These systems are arranged to give a code fire signal on single stroke gongs which may be heard simultaneously throughout the premises covered by the installation. Each signal station has its distinctive number or code which, when rung, warns every occupant immediately of the fire and its location. Every wire in the complete system is under constant electrical supervision and a trouble signal is sounded should any line become opened or the operating current fail. The Samson fire alarm systems are made to operate on 110 volts direct or alternating current, also on the Samson battery. These systems have also been approved by the Industrial Commission of the State of New York.

Diamond Power Specialty Co., Detroit, Mich., announces that in order to continue to carry out its policy of maintaining close touch with all installations of Diamond soot blowers, it has become necessary to divide the work of its service department. As the number of installations of this equipment have increased and the scope of work handled by the department broadened, it has become increasingly difficult to give close attention to all customers. The company has, therefore, thought it desirable to divide the service work into eastern and western districts. The eastern district comprises the states of Pennsylvania, West Virginia, Delaware, and all states north and east thereof. The western district covers the remainder of the United States. E. M. Eliot, who has heretofore been in charge of the service department, will serve as eastern manager. E. K. Uebe, one of the most experienced soot blower engineers in the country, has been appointed western manager.

Cooper Hewitt Electric Co., Hoboken, N. J., is distributing an attractive calendar for the year May 1919-1920. It is 12½x18 in. in size and is printed on a good quality of paper. Illustrations of typical installations of Cooper Hewitt lighting equipment appear on each page of the calendar, giving an idea of the effectiveness of these lamps as applied to various industries.

Ohio Brass Co., Mansfield, Ohio, is distributing Catalog No. 17, superseding Catalog No. 16. The new book of 672 pages contains descriptions and lists the entire line of O-B electrical products, comprising Hi-Tension insulators, pole hardware, trolley materials, catenary materials, rail bonds, third rail insulators and car equipment specialties. For the convenience of those who are interested only in Hi-Tension insulators and their accessories, a small book has been prepared containing those materials just as they appear in the catalog, but omitting the other classes of materials. A copy of either the general catalog or the insulator section may be obtained by addressing a request to the Mansfield office. The company also announces that its Chicago office has been moved from 508 to 1217 Fisher building.

William J. Norton, of Norton, Bird & Whitman, has completed his work as general superintendent of the Aberdeen Proving Ground contract of the Maryland Dredging & Contracting Co., and in addition to his offices in Chicago, Baltimore and Boston, has opened offices in the Astor Trust building, 501 Fifth avenue, New York City, where he will continue his consulting work on utility rate regulation problems. In addition, in association with the Withington-Roberts-Wright Co., of Cleveland, Ohio, industrial architect and engineer, he will engage in general industrial engineering, including certain large construction projects upon which preliminary surveys are now under way. It is of additional interest that Travis H. Whitney, who has just retired as chairman of the New York City Public Service Commission, will become counsel to Mr. Norton and his associates, occupying offices with them at 501 Fifth avenue, New York City, and will also be associated with them in projected enterprises. Mr. Whitney is a lawyer of very broad experience in utility matters. In 1907, when the original Hughes Public Service Law was passed, he was made secretary of the New York City Commission, and continued as such until he was appointed a commissioner in 1916 by Governor Whitman. Since January 1st he has been acting as chairman, but now retires upon the appointment by Governor Smith of Honorable Lewis Nixon.

William Dubilier, of the Dubilier Condenser Co., Inc., New York City, has written a very interesting booklet of 30 pages entitled "The Wonderful Achievements of Radiotelegraphy in War and Peace." It not only discusses applications of radio communications but contains a detailed description of radiotelegraphic apparatus, with particular reference to the Dubilier condenser.

Dayton Fan & Motor Co., Dayton, Ohio, recently reorganized, plans to greatly increase its facilities and will build new factories immediately which will provide a floor space of approximately 100,000 sq. ft. Motors for washing and ironing machines, vacuum cleaners, churns and other electrical household appliances are to be manufactured. The officers of the reorganized company are as follows: President, O. Waymire; vice-president, Lee Warren, secretary and treasurer, Clyde C. Miner. Mr. Miner, who has been connected with the Robbins & Myers Co., Springfield, Ohio, for the past 20 years as general auditor and credit manager, has purchased the interests of Walter F. Phelps in the Dayton Fan & Motor Co.

Change in Personnel of Foster-Raetz Electric.—An important business change is the retirement of E. M. Raetz, from the Foster-Raetz Electric Co., of Rochester, Minn., George L. Morrison taking over his interest. Mr. Raetz came to Rochester in 1907 to engage in some work at the Rochester state hospital. He later associated himself with William Kennedy, later organizing the Kennedy Electric Co. In 1912 he took over the business and conducted it under the name of E. M. Raetz & Co., until 1916, when the Foster-Raetz Electric Co. was organized. This concern took over the interests of the Foster Electric Co. The firm has enjoyed a thriving business in its various lines, especially the sale of labor-saving household appliances. Mr. Morrison has been in charge of the electrical work at the Clinic since the completion of the new building. Mr. Raetz plans on taking a manufacturers' agency in the Minneapolis territory.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Manchester, Vt. — Equinox Spring Co. will install new electrically operated pumping machinery.

Rutland, Vt. — Rutland Railway, Light & Power Co. will supply the Marble City Manufacturing Co. with power for the operation of its entire equipment, which includes individual motors for the machine tables and motor driven apparatus for the cutting machines.

North Poultney, Vt.—Pincus & Donnelly Co. has purchased new apparatus to equip its slate quarry with electric motor drive. This equipment includes a hoist motor and an electrically driven pump. Later on a compressor will be installed, requiring an additional 50 hp.

Springfield, Vt.—Colonial Power & Light Co. is proceeding with plans to enlarge its plant and to practically double its capacity. The erection of a new substation and office building is to begin immediately on Clinton street, the contract for the work having been awarded to McDonald & Toslyn, of Boston. In addition to the building there will be an outdoor substation, double the present capacity, and will require the installation of new and improved equipment.

Springfield, Vt.—Springfield Brass Co. plans the installation of a new electric furnace with auxiliary apparatus at its works.

St. Albans, Vt.—Plans are being prepared by the Public Electric Light & Power Co. for the erection of an addition to the power station and transmission line equipment at Fairfax.

Boston, Mass.—In a statement recently made by the trustees of the Boston Elevated Railway, it is estimated that a total of $19,500,000 will be required during the next five years, this to include $5,000,000 to be used for power purposes; $8,500,000 for new rolling stock; and $2,500,000 for shop work, etc.

Worcester, Mass.—American Steel & Wire Co., 94 Grove street, has commenced work on alterations and improvements in one of the buildings of its plant, to facilitate operations.

Worcester, Mass.—Worcester Electric Light Co. is completing arrangements for the issuance of about 4000 additional shares of its capital stock, in accordance with permission recently granted by the Electric Light Commission. A portion of the proceeds will be used for improvements and extensions in its system, including the installation of about two miles of underground conduit system. At the present time the company is installing a 20,000-kw. turbine generator, with blowers, piping and auxiliary equipment.

Providence, R. I.—Revere Rubber Co., Valley street, is making rapid progress in the construction of the new one-story power plant at its works on Valley street, and miscellaneous contracts have been awarded. The structure will be about 52x94 feet, and will be used for increased capacity. J. W. Bishop Co., Worcester, Mass., is the building contractor.

Albany, N. Y.—F. W. Newman & Son, 21 Philip street, Albany, have submitted the low bid to the Board of Contract & Supply for electrical work in connection with the proposed construction of Public School No. 19, to be located on New Scotland avenue, at $2745.

Albion, N. Y.—The citizens have voted to issue $6000 in bonds for lighting. Address town clerk.

Belmont, N. Y.—The sum of $10,000 in bonds has been voted for a municipal light plant. Address town clerk.

Binghamton, N. Y.—Link Piano Co., manufacturer of electrically operated pianos, Water street, has filed notice of an increase in its capital from $75,000 to $105,000, for expansion.

Brooklyn, N. Y.—Brooklyn Edison Co. is now producing an aggregate of about 150,000 hp. at its Bay Ridge generating plant, 66th street, a large part of which is being utilized for local industrial power. The company has a large number of consumers for this class of service, among them being the E. W. Bliss Co., the American Manufacturing Co., and others. Including private service for dwelling and apartment use, an aggregate of about 125,000 customers is being served.

Buffalo, N. Y.—The Board of Supervisors of Erie county is having preliminary plans prepared for the construction of new penitentiary buildings, to be located at Wende, N. Y., to include power house, refrigeration building, dormitories, laundry, and other structures, the project being estimated to cost $1,000,000. Alonzo G. Hinckley, 29 City Hall, is clerk.

Gloversville, N. Y.—Kingsboro Silk Mills have awarded a contract for the erection of a new one-story boiler plant in connection with the construction of a new local factory on Glenmont avenue. Estimated cost $20,000.

New York, N. Y.—Plans have been completed by the Nilsson Realty Co., 560 West 233rd street, for the erection of a boiler plant in connection with a new greenhouse, one-story, about 75x100 ft., to be located on East Side boulevard, south of 233rd street. Estimated cost, $20,000.

New York, N. Y.—Cutting Radio Corp. has leased space comprising the entire fifth floor in the building at 304-20 Hudson street, for a new establishment.

Thiells, N. Y.—Final contracts have been awarded by the Board of Managers of Letchworth Village, operated by State authorities, located at Thiells, for the installation of the proposed new equipment and the construction of a large new central heating plant at the site. Contract for the erection of the new plant has been awarded to George B. Wright, Garnerville, at $32,200.

Watertown, N. Y.—Northern New York Utilities Co., 58 Public Square, has completed plans for the construction of a new brick, concrete and steel power plant in connection with its new development on the Black river, Watertown. The work will include the construction of a new dam, with canal system, the entire project being estimated to cost $250,000. James P. Brownell, 19 Strickland block, Carthage, is engineer for the company.

Bayonne, N. J.—Watt Electric Co. has filed notice of organization to operate at 810 Broadway in a general electrical contracting capacity. Julian M. Rissier, 104 West 47th street, heads the company.

Hillside Township, N. J.—In connection with the new plant of the Bristol-Myers Co., 277 Greene street, Brooklyn, N. Y., to comprise a group of factory buildings, administration structure, etc., a one-story boiler plant, about 44x94 ft. will be erected The company operates works at this location at the present time, and the new group will be to provide for increased capacity.

Newark, N. J.—Anzivino & Lallone have filed notice of organization to operate at 288 Hunterdon street in a general electrical contracting capacity. Michael Lallone and Joseph Anzivino, 409 South 10th street, head the company.

Newark, N. J. — Jamouneau-Myll Co., 17 Academy street, has filed notice of organization to operate in a general electrical contracting capacity. Rosslyn Jamouneau, 388 Roseville avenue, and Ernest L. Myll, 37 Kearny street, head the company.

Trenton, N. J.—Trenton & Mercer County Traction Corp. is making rapid progress on the installation of new engine equipment at its power plant, and it is expected that the work will be completed at an early date.

Trenton, N. J.—Trenton & Mercer County Traction Corp. has filed application with the Board of Public Utility Commissioners for permission to issue bonds for $40,000, the proceeds to be used for the construction of the proposed extension to its Trenton Junction lines.

Allentown, Pa.—The city of Allentown contemplates installing a municipal lighting system and Frank Koester, consulting engineer and city

planning expert, 50 Church street, New York City, has been retained to prepare a report on this subject. This report shows that, while the city now pays the local company $51,000 per year for street lighting and $2000 for building lighting, if the city installs an electric generating plant in connection with the municipal water works, a yearly saving of $19,000 will be effected. Mr. Koester recommends replacing the present arc-light system with gas-filled tungsten lamps, to secure not only greater illuminating effect but also smaller operating cost. The plant, of 350 kw. capacity, will also take care of future extension to the present lighting system. The boulevard lighting on the main business thoroughfare, which is recognized as one of the most effective and economical lighting systems throughout the country, was installed in 1916 on the recommendation of Mr. Koester, who was then retained by the Allentown City Planning Commission in advisory capacity as a city planning expert. Many of the recommendations made in Koester's city planning report have since been adopted by the city.

Allentown, Pa.—Allentown & Reading Traction Co. is making rapid progress in the construction of a new extension to its traction system on Walnut street.

Altoona, Pa.—Penn Central Light & Power Co. has filed notice with the Public Service Commission of a bond issue for $119,900, a portion of the proceeds to be used for extensions, improvements, etc.

Bradford, Pa.—Notice has been filed with the Public Service Commission by the Bradford Electric Co. of a bond issue for $400,000, a portion of the proceeds to be used for extensions and betterments, etc.

Erie, Pa.—Erie Lighting Co. has filed notice with the Public Service Commission of the issuance of bonds for $1,850,000, a portion of the proceeds to be used, it is understood, for extensions, improvements, etc., in its plant and system.

Hazelton, Pa.—Harwood Electric Co. has recently filed a new schedule of increased rates for service with the Public Service Commission.

Philadelphia, Pa.—Powers, Weightman & Rosengarten, Ninth and Parrish streets, have awarded a contract to R. C. Ballinger & Co., 218 North 13th street, for the construction of a one-story brick boiler plant addition to be located at 35th and Moore streets.

Philadelphia, Pa.—Two ordinances have been introduced in the City Council calling for appropriations of $10,000 and $25,000, respectively, for the installation of additional lighting units in various sections of the city, including outlying districts. It is set forth the lighting facilities are very inadequate in the area bounded by 7th, 15th and Johnson streets and Oregon avenue, at which place a total of 600 houses were erected by the Government.

Philadelphia, Pa.—Lloyd Garrett Co., 229 North 23rd street, has acquired property at 1609-13 North Front street, formerly owned by the National Galvanizing Co., and at 1615 North Front street, for proposed business expansion. The company manufactures electric and gas fixtures, etc.

Waynesboro, Pa. — Waynesboro Electric Co., operating the Chambersburg, Greencastle & Waynesburg Electric Railway, has inaugurated preliminary work for the construction of a new high-tension power system from the present terminus at Blue Ridge Summit to Greenstone, a distance of about two miles. The proposed transmission line will be constructed via the Monterey and Charmian districts, and will be used for stone-crushing operations and other industrial work at Greenstone.

Williamsport, Pa.—Citizens Electric Co. is having plans prepared for an electrical plant, 60x120 ft. at an estimated cost of $250,000.

Welch, W. Va.—Welch Armature Co. is planning the erection of a three-story plant for increased output.

Benson, N. C.—The city has awarded a contract for the construction of a new municipal electric light system. Gilbert C. White, Durham, N. C., is engineer.

Bridgewater, N. C.—Southern Power Co., of Charlotte, arranged for Rinehart & Dennis Co., of Charlottesville, Va., to take over and complete Sydo hydroelectric development, including dams and power house. Four hundred thousand dollars will be expended.

Pensacola, Fla.—The Navy Department is having plans prepared for the installation of a new underground conduit system at its local station, estimated to cost $114,000. The department has also been submitted a low bid by the D. C. Barrow Electric Co., 714 12th street, N. W., for the proposed improvements in the local electric power plant, at $54,600.

Atlanta, Ga.—Georgia Railway & Power Co. is arranging plans for additional water power development on the Tugaloo river.

Moultrie, Ga.—The city is planning to call a special election in June to vote on the issuance of bonds for $150,000, to provide for extensions and improvements in the municipal electric light plant.

Unadilla, Ga.—The city will install an electric lighting plant. Address C. B. Morgan, mayor.

NORTH CENTRAL STATES.

Castalia, Ohio.—Castalia Portland Cement Co. will expend $80,000 to build an addition to its factory. The building will be brick, concrete and steel construction, steam heating, plumbing, composition roofing, fireproof interior finish and electric lighting. The specifications include three motors 200 hp. and 800 hp. pumping motor for pumping water from Lake Erie. Contracts will be let by the owners.

Cleveland, Ohio.—Standard Oil Co., 316 East Ohio Gas building, will erect one-story brick and concrete pump house at 3083 Broadway. Estimated cost $25,000.

Lebanon, Ohio.—A $140,000 electric light plant will be erected here. The building will be brick and concrete construction, electric heating, plumbing, composition roofing, fireproof interior finish, and electric lighting. Address Bert Monger, clerk of the council.

Massillon, Ohio.—The sum of $12,000 in bonds has been voted to provide for an underground police and fire alarm system. Address city auditor.

Oberlin, Ohio.—May 27 an election will be held to decide the question of issuing $50,000 in bonds for the purpose of constructing a plant for the

DATES AHEAD.

Southwestern Electrical and Gas Association. Annual convention, Galveston, Tex., May 12, 13, and 14. Headquarters, Hotel Galvez. Secretary, H. S. Cooper, 403-404 Slaughter building, Dallas, Tex.

American Association of Engineers. Annual meeting, Chicago, Ill., May 13-14. Secretary, C. E. Drayer, 29 South La Salle street, Chicago, Ill.

National Electric Light Association. Annual convention, Atlantic City, N. J., May 19-23. Secretary, T. C. Martin, 33 West 39th street, New York City.

Electric Power Club. Annual meeting, Hot Springs, Va., May 22, 23 and 24. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

Vancouver Association Electrical Contractors and Dealers. Convention, Vancouver, B. C., May 26 and 27. Secretary, Capt. W. J. Conway, 406 Yorkshire building, Vancouver, B. C.

Illinois Association of Electrical Contractors and Dealers. Summer convention, Decatur, Ill., June. Secretary, N. M. Blumenthal, 179 West Washington street, Chicago.

Electrical Supply Jobbers' Association. Annual convention, Hot Springs, Va., June 10, 11 and 12. Headquarters, The Homestead Hotel. Secretary, Franklin Overbagh, 411 South Clinton street, Chicago.

Tri-State Water and Light Association. Annual convention, Greenwood, S. C., June 17-19. Secretary-treasurer, W. F. Stieglitz, Columbia, S. C.

American Society of Mechanical Engineers. Spring meeting, Hotel Statler, Detroit, Mich., June 17-20. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Summer meeting, Boston, Mass., June 18-21. Secretary, Prof. J. C. Olsen, Polytechnic Institute, Brooklyn, N. Y.

American Institute of Electrical Engineers. Annual convention, Adirondacks, N. Y., June 24-27. Headquarters, Lake Placid Club. Secretary, F. L. Hutchinson, 33 West 39th street, New York.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Meeting. Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., October. General secretary, Clarence L. Law, 29 West 39th street, New York City.

manufacture and distribution of electric light and power.

Port Clinton, Ohio.—Port Clinton Electric Light & Power Co. has been awarded a contract by the city for additional electric energy for the operation of new lighting units to be installed in the lake front section.

Sandusky, Ohio.—Sandusky Gas & Electric Co. has recently completed the installation of four new Sanford Riley three-retort type underfeed stokers at its plant.

Waverly, Ohio.—Bonds to the amount of $11,000 have been voted to repair the municipal electric light plant. Address village clerk.

Columbus, Ind. — Central Indiana Lighting Co. has asked permission of the Indiana Public Service Commission to abandon its service on Maple Grove street.

Evansville, Ind.—Blount Plow Co. will erect a large factory building at the plant of the Hartman Manufacturing Co., which they recently purchased.

Decatur, Ill.—Decatur Railway & Light Co. has purchased a tract of land 125x500 ft. on Woord street, just west of the Illinois Central railroad, and will erect new barns and city shops. The first building to be erected will be the paint shop, to be followed by the barn and the repair shops. The company will consolidate its work at this point and will abandon the old barns.

Gillespie, Ill. — Southern Illinois Light & Power Co. will erect a power house at an estimated cost of $80,000.

Lewistown, Ill.—The council is planning ways and means to improve street lighting. The County Board of Supervisors are favorable to the plan and promise to vote favorably for the county to buy the posts and fixtures so as to have a post on each of the four corners of the court house square and two posts for each entrance to the grounds. This would be done with the understanding that the county would furnish the fixtures if the city would pay for the electric current for the lighting.

Algonac, Mich.—Detroit Edison Co. officials are negotiating for the purchase of Algonac electric light plant and appraisers are going over the property. The purchase plan will be submitted at a special election. The company will also apply for a franchise for town and village and townships.

Detroit, Mich.—Stecker Electric & Machine Co. has let contracts for the erection of an electric vacuum cleaner manufacturing plant.

Kinde, Mich.—The council let contract to the Electric Supply Co., 107 South Water street, Saginaw, Mich., at $10,000 for electric lighting system at Kinde.

Centerville, Iowa.—F. S. Payne and D. C. Bradley have sold the Iowa Southern Utilities Co. to David C. Fisher & Co. of Davenport, Iowa. The plant is valued at $2,500,000 and has been in operation for 20 years. Incorporates 3 miles of elctric interurban and lighting plants in 25 towns.

Sioux City, Iowa.—Plans for building a power plant in the Floyd Valley to supply light and power for the mills, elevators and other industrial plant that are to be located there are under consideration by Sioux City business men and grain men who have been active in the development of the valley. The new plant will be owned and operated by the managements of the various industries located in the valley, and the cost of operation prorated among those benefited. Address city clerk.

Clayton, Kans.—Bonds were voted upon favorably at the recent election to the amount of $10,000 for putting in a transmission plant to Norcatur, so that Clayton will have electric service.

Topeka, Kans.—The State House Committee will let contracts May 27 for improving the state house light and heating plant. Address secretary of the building committee.

Topeka, Kans.—Pawnee Power & Water Co. was granted the authority to issue $50,000 bonds for the purpose of building a new power line to Burdette from Larned through to Pawnee Valley.

Clarksville, Mo.—Clarkesville Electric Light & Water Co. has been granted a franchise to install an electric light and power plant.

Kansas City, Mo.—Kansas City Hay Press & Tractor Co. will erect new tractor plant, 150x320, to cost $60,000. The company has recently increased its capital from $300,000 to $1,000,000.

St. Joseph, Mo.—Columbian Electrical Co. has filed in the office of the county recorder notice of increase of capital stock from $30,000 to $100,000.

St. Joseph, Mo.—Improvements in its plant equipment to cost approximately $1,000,000 are planned by the St. Joseph Railway, Heat, Light & Power Co.

St. Joseph, Mo.—The Municipal Ownership League is concentrating its efforts upon securing the passage of the municipal electric light plant bonds. An open meeting was recently held and all speakers urged that the issue be made the concern of all members of the league and that wide publicity be given the issue.

Sikeston, Mo.—An election will be held June 2 to vote on the question of issuing $75,000 electric light bonds. Address mayor.

Ohiowa, Neb.—The question of issuing light and water bonds will be submitted to vote. Address village clerk.

Trumbull, Neb.—The town will expend $6,000 for municipal light plant. Address town clerk.

Pakwana, S. D.—Bonds have been voted for municipal lighting. Address mayor.

Vermillion, S. D.—Bonds have been voted for improving the municipal light plant. Address city clerk.

SOUTH CENTRAL STATES.

Louisville, Ky.—Louisville Water Co. is arranging plans for the construction of a large boiler plant at its river pumping station, estimated to cost, with equipment, $350,000. The structure will be one-story, about 75x150 ft. Plans are also being prepared for the erection of a pumping plant to be located in the Crescent Hill district, estimated to cost in excess of $200,000. James B. Willson is chief engineer.

Clarksdale, Miss.—The city commissioners will expend about $300,000 in reconstructing and improving the municipal electric light and power plant.

Lake Charles, La.—At a meeting of the City Council, Commissioner of Streets and Parks E. S. Crosby advocated the immediate extension of the waterworks system, the installation of more fire plugs and additional street lights.

Ashdown, Ark.—Ashdown Light & Power Co. is considering plans for the reconstruction of its electric plant recently destroyed by fire, with loss estimated at about $35,000.

Mobile, Ala. — Announcement is made that H. M. Byllesby & Co., owners of the power plant of the Mobile Electric Co., will build a new power plant at some point on the Mobile river or Three-Mile creek. The company expects to spend about $1,000,000. The new plant will be erected in addition to the present power house at Royal and St. Anthony streets, which was partially wrecked by an explosion recently. It will be so constructed as to furnish all the electric power that is called for by industrial plants and for other purposes.

Montgomery, Ala. — Montgomery Light & Traction Co. has made application to the city commission for privilege of extending the electric railway line to Wright Field, a distance of about a mile.

Blanchard, Okla.—The Board of Trustees of Blanchard has called a special election for the purpose of voting on the proposition of bonding the city for the purpose of erecting a municipal water and light plant. It is proposed to vote $45,000 for the water plant and $15,000 for the light plant.

Muskogee, Okla.—An appraisement of the physical valuation of the property of the Muskogee Gas & Electric Co. is to be made by the corporation commission, according to notice received here. The appraisal was started May 1st under the direction of the corporate commission's engineer.

Newkirk, Okla.—It is proposed to vote $110,000 for the construction of a municipal light plant and service lines.

Norman, Okla.—The city has approved the issuance of bonds for $125,000 for the installation of a municipal electric light and power plant.

Oklahoma City, Okla.—The attorney general recently approved bond issues of the city of Yale of $100,000 for the extension of the electric light system, $100,000 for waterworks improvements and $20,000 for additional fire equipment.

Tahlequah, Okla.—The city will construct a dam and generate electricity for municipal lighting plant. Address Professor Gladstone of Uni-

versity of Arkansas, engineer, Fayettsville, Ark.

Chattanooga, Tenn. — Tennessee River Power Co. will rebuild its electric power station on Carter street, recently damaged by fire.

Abilene, Tex.—Abilene Gas, Electric, Ice & Water Co. will rebuild the electric light and water pumping plant which recently burned at loss of $300,000.

Abilene, Tex. — The electric light and power plant and the water works plant of the American Public Service Corp. at Abilene, which were recently destroyed by fire, will be rebuilt as soon as machinery and material can be obtained, it is announced. The new plants will cost about $300,000.

Bogata, Tex.—The Bogata Commercial Club has pledged a bonus of $1000 for the construction of a lighting circuit connecting Blossom, Deport, Bogata, Fulbright and Detroit with the wires of the North Texas Power Co. at Paris.

WESTERN STATES.

Marshfield, Ore.—Mountain States Power Co. has closed a contract with the Johnson Lumber Co. at Coquille, Ore., for 150 hp. in motors. This is in addition to the present power installation of the company which expects to install additional motors in the near future.

Highball, Ariz.—Arizona Power Co. will construct a 4000-volt electric power transmission line from its power station near here to Phoenix, 70 miles. The purpose of the proposed line is to provide auxiliary power for the Pacific Gas & Electric Co.'s system at Phoenix. The Arizona Power Co. also has other improvement extensions of its power transmission system under consideration.

Pueblo, Colo. — Arkansas Valley Railway, Light & Power Co. will serve the Pope block with 100 hp. of electrical energy covering its entire lighting and power requirements. The private plant which was formerly operated in this building will be abandoned. The company has completed the installation of 20 250-watt Mazda street lamps in Minnequa Heights.

Mackay, Ida.—Public Utilities Commission of Idaho has granted the MacKay Light & Power Co. a certificate of convenience and necessity, enabling the company to furnish electric service for the entire Lost River Valley. The company will expend approximately $50,000 in this extension and will furnish service to the towns of Arco, Moore, Leslie and others in the Lost River Valley.

Seattle, Wash.—It is reported that the Horne Manufacturing Co. will locate a factory in Seattle for the manufacture of marine electrical equipment.

Fresno, Cal.—Considerable electrical and mechanical equipment, packing machinery, conveyor systems, etc., will be installed in the new plant which the California Associated Raisin Co. will erect. The work is estimated to cost $750,000.

Pine Bluffs, Wyo.—The citizens will vote on the question of issuing light and water extension bonds. Address city clerk.

Oakdale, Cal.—Frank B. Pattee, Oakdale, and Samuel Bernhard, San Francisco, are planning for the construction of a hydroelectric power plant on the north fork of the Stanislaus river, with initial capacity of about 10,000 hp. It is proposed to furnish electric power to industries in this section.

San Francisco, Cal.—Great Western Power Co. has inaugurated preliminary survey and other work in the Feather River Canyon, near Oroville, for its proposed hydroelectric power plant in Butt Valley. It is planned to inaugurate active construction work in the near future, with the construction of a railroad along Butt Creek to the power station site for the transportation of electric machinery, etc. The entire project is estimated to cost about $5,000,000. The station will be tied in with the transmission system of the company by new lines.

San Francisco, Cal.—The State Water Commission has granted permission to Lars R. Jorgensen, San Francisco, for the appropriation of water on the north fork of the Yuba river for power purposes. It is proposed to establish a hydroelectric power plant on the site with initial generating capacity of about 7700 hp. For this purpose a concrete arch dam, 450 ft. long and 170 ft. high will be constructed. The entire project is estimated to cost about $2,000,000. It is understood that a company will be organized to build and operate the new plant.

Stockton, Cal.—The Samson Sieve Grip Tractor factory, which has been responsible for many of the "tanks" used by the Allies in the war, has completed arrangements to enlarge its plant at Stockton and begin operations on a greatly enlarged scale.

MEXICO.

City of Mexico, Mex.—It is announced by the Department of Industry and Commerce of the Mexican government that it has before it a proposition by private interests to construct three large water storage dams on the Conchos river in the state of Chihuahua and the installation of a hydroelectric plant. The proposed plant will generate about 100,000 hp. The project involves the construction of a large system of power transmission lines. The Mexican Northern Power Co. already has a large dam and hydroelectric plant on the Conchos river practically finished. The new proposition is said to be separate and distinct from that of the Mexican Northern Power Co.

NEW PUBLICATIONS

Electrical Characteristics and Testing of Dry Cells.—The Bureau of Standards, Department of Commerce, has issued Circular No. 79 entitled "Electrical Characteristics and Testing of Dry Cells." This circular summarizes the available information on dry cells and gives a brief description of the materials and methods of construction and elementary theory of the operation of the cells. The various sizes and kinds of dry cells on the American market are described. It discusses the electrical characteristics of the cells and methods of testing them. In an appendix are given the proposed specifications for dry cells which have been prepared by the Bureau. Those interested in this publication may obtain a copy by addressing a request to this Bureau.

"How Business with Foreign Countries is Financed" is the title of a booklet just issued by the Guaranty Trust Co. of New York for the benefit of exporters and importers and others having business or financial relations with foreign countries. The booklet contains 28 reproductions of specimen forms of drafts, letters of credit, bills of lading, invoices, and other documents generally used in connection with the financing of exports and imports. Explanatory notes accompany each illustration and features in the documents of particular importance are noted. The use of the documents is also explained when that seems necessary. Special attention is given to those which bear directly upon the development of dollar exchange. The booklet is printed in attractive type upon coated paper and is carefully indexed. At the end there is a table of currencies of various countries and their value in United States dollars. The booklet will be sent free on request.

INCORPORATIONS

Sutter Siding, Ill.—Rittle Electric Light Co. has incorporated with a capital of $4000 by Charles Graff, Val Springer and C. E. Martin.

York, Pa.—American Electric Steel Co. has incorporated with a capital of $125,000 and will build a plant in the eastern section of the city. The company will make semi-finished castings, etc. A special high-tension line from the electric power plant at York Haven will supply the new plant with electricity.

New York., N. Y.—John J. Leahy Electrical Supplies, Inc. Capital, $150,000. To manufacture and deal in electrical supplies, apparatus, etc. Incorporators: J. J. Leahy, T. L. Gorman, and P. J. McSwenney, 533 Tinton avenue.

New York, N. Y.—Arrow Flexible Conduit Co. Capital, $6000. To manufacture electric conduits, etc. Incorporators: A. Rappaport, H. Ginsburg, and M. Janiger, 218 Grand street.

New York, N. Y.—Meyer, Strong & Jones. Capital, $50,000. To engage in a general electrical enginering capacity. Incorporators: S. M. Meyer, J. L. Dunn and L. H. Hohell, 20 Exchange place.

Augusta, Me.—Wilson Brothers & Kent, Inc. Capital, $1,000,000. To manufacture and deal in power and pumping equipment and kindred apparatus. Incorporators: E. L. McLean, S. L. Fogg, C. R. Chapman, E. M. Leavitt, D. A. Lesland, and G. M. Benson, Augusta.

Personal

Lieut.-Col. A. J. Griswold to Represent Western Electric in France — H. M. St. John Joins Detroit Furnace Co.

LIEUT. C. E. PRETZ, Engineer Corps, U. S. Army, has recently been discharged from the service and resumed work with the Public Service Commission, First District, New York.

J. A. WHITE has resigned his position with the Nagel Electric Co., Toledo, Ohio, to join the industrial department of the Westinghouse Electric & Manufacturing Co., East Pittsburgh.

CHESTER MOTT, formerly sales engineer at Spokane, Wash., for the Sullivan Machinery Co., Chicago, has been placed in charge of the Denver office of the company at 837 Equitable building, succeeding Wallace T. Roberts, resigned.

FRED D. FAUSER, claim agent for the Peoria Railway Co. and the Illinois Traction System, with headquarters at Peoria, Ill., has gone to St. Louis to assume the position of chief claim agent for the St. Louis Terminal Railway Association.

DUNCAN G. SINCLAIR, formerly chief assistant engineer for the Pittsburgh Railway Co. and the Duquesne Light Co., has been appointed New York manager for the Pittsburgh Piping & Equipment Co. He will make his headquarters in the St. Paul building, 220 Broadway.

W. H. SAWYER, vice-president of the E. W. Clark & Co. Management Corp., was recently elected president of the East St. Louis Suburban Railway Co., East St. Louis Railway and Alton, Granite & St. Louis Traction Co., and vice-president of the St. Louis & Belleville Electric Railway, Alton Gas & Electric Co. and St. Louis & East St. Louis Electric Railway.

LIEUT.-COL. AUGUSTUS H. GRISWOLD, recently discharged from the service and formerly an engineer with the Pacific Telephone & Telegraph Co., has been called upon to again go abroad as the representative of the Western Electric Co. to act as chief engineer. He will be in charge of engineering and installing a line telephone plant and service for the French government, with the possibility that his duties may extend to England, Holland, Belgium and Italy. Colonel Griswold was the major in charge of the 411th Telegraph Battalion until April 4, 1918, when he was attached to the staff of the Chief Signal Officer in Tours, in which position he acted as director of telephone and telegraph service. This involved the construction, installation, operation and maintenance of telephone and telegraph lines and stations in France and England. He was promoted to his present rank on Sept. 27, 1918. On Dec. 1, 1918, he was called to Paris, where his duties were directed toward the disposition of the Signal Corps property then on hand, amounting in value to approximately $4,000,000.

CHARLES LUNDGRE has resigned as general master mechanic of the National Tube Co. mills at Lorain, Ohio, to become master mechanic of the new plant of the American Steel & Wire Co., near Birmingham, Ala.

F. S. HEALY, chief engineer of the Epping-Carpenter Pump Co., Pittsburgh, has been appointed in addition to the position of manager of sales, succeeding F. F. Woods, who is now located in New York as eastern sales manager.

H. M. ST. JOHN, chemical engineer for the Commonwealth Edison Co., Chicago, has resigned to become general manager of the Detroit Electric Furnace Co., of Detroit. During the summer of last year he enlisted in the national service and on August 1 was commissioned a captain in the Chemical Warfare Service, and immediately engaged in development work and research at

Capt. H. M. St. John.

Willoughby, Ohio. He obtained his honorable discharge and returned to the Commonwealth Edison Co. during the latter part of March. Previous to entering the army Captain St. John spent five years with the Edison company, during which time he was engaged principally on electrochemical and electrometallurgical research. He also made extensive tests and experiments on the electric furnace for melting steel and brass. He also investigated various electrolytic processes and paved the way for their general utilization by central stations for load-building purposes. This work necessitated a large amount of rate making. He has been a frequent contributor to the technical press and has presented a number of valuable papers before the electrical and chemical societies. In going to the Detroit Electric Furnace Co., Captain St. John will take with him a very wide experience gained in the central-station field, his experience specifically embracing utility rates, power supply for industrial purposes and electrochemical processes. Prior to his departure Captain St. John was tendered a dinner by a few of his many friends in the industry who had gained enthusiasm and inspiration by their contact with an able and gifted engineer and chemist, a willing co-worker and capable executive.

R. A. BUCHANAN, supervisor of the construction department of Western Electric Co., recently arrived at Seattle from the East, expecting to spend several months in the Pacific Northwest.

R. W. SPOFFORD has been appointed local general manager of the Manila Electric Railroad & Light Co., Manila, Philippine Islands, by the J. G. White Management Corp., New York, N. Y., the operating manager of that company. Mr. Spofford was graduated from the United States Naval Academy at Annapolis, and spent about five years in the navy. He was retired in 1911. Shortly thereafter he was engaged by the J. G. White Management Corp. and was assigned to the staff of the Augusta-Aiken Railway & Electric Corp., Augusta, Ga., and later was made general manager of that company. When the United States entered the world war, Mr. Spofford, as a naval reserve officer, was called to the colors for service. With the signing of the armistice he was again placed on the retired list of the navy, with the grade of lieutenant commander.

Obituary.

SAMUEL DAY, who has been connected with the New Jersey Power & Light Co., at Bernardsville, N. J., for the past three years, as line foreman, died on April 24, 1919.

JAMES FREDERICK HAINSWORTH, for many years employed in the auditing department of the Nebraska Power Co., Omaha, Neb., died on May 2 at the age of 65 years.

T. HAROLD NICKOLS, Brooklyn, N. Y., a well known electrical engineer, formerly an inspector of electrical work at the Brooklyn Navy Yard, died on April 24, at his home, 506 East Seventh street, aged 28 years.

COL. RICHARD H. ABBOTT, president of the Abbott Light & Power Co., Petersburg, Ill., died May 3 at St. John's Hospital, Springfield, Ill. He was active in the affairs of the Illinois National Guard for 20 years and for several years up to the time of his death a member of Adjt.-Gen. Dickson's staff. During the war he was occupied with the organization and mustering in of the state militia. Colonel Abbott was born in 1870 near Mason City, Ill., and later made his home at Petersburg. He was one of the organizers of the Abbott Light & Power Co., one of the largest public utility corporations in central Illinois. Colonel Abbott was president of the Petersburg (Ill.) Commercial Association and a leader in the affairs of his community. His widow and one son, Richard H. Abbott, JrJ., survive him.

Financial News

British Reconstruction Freed from Financial Restriction.

The British treasury officials have decided to remove all restrictions on new capital issues for industrial or trade development purposes within the United Kingdom. Treasury license will no longer be required. The step is regarded as significant by the American Chamber of Commerce in London not only because of its importance to the reconstruction of British businesses at home but also because it foreshadows a similar release of the control on capital issues for British enterprises in America and elsewhere.

As a control over conditions affecting British exchange, treasury license will still be required for foreign issues—at least until the recent "unpegging" of the exchange shall have shown the effect it is going to have on British commercial finance. British business, however, neither wishes nor expects it to be long before freedom will be granted to its financial plans for enterprises in foreign countries—particularly the United States.

Meanwhile the removal of the restrictions at home will probably result in many new expansions and more huge combinations for world trade like those which have recently been attracting attention.

General Electric Reports.

The annual report of General Electric Co. for 1918 records the largest volume of business in the history of the company, gross earnings for the year having aggregated $216,815,277. This amount represents an increase over the preceding year of $19,888,590 and compares with the 1914 gross of $90,467,691. Net profits available for dividends after provision for federal taxes was estimated at $13,500,000, as compared with net of 1917, amounting to $26,903,328. In 1917 the tax item was only $5,500,000. The total surplus after paying dividends for the year was $57,838,059 as of Jan. 1, 1919. From this amount was subtracted a 4% stock dividend amounting to $4,587,398. The sum of $21,593,996 was expended for building machinery and other equipment needed for the manufacture of war materials, and in view of the fact that a portion of the additions would be unused and in consideration of the high costs, $15,224,162 was written off the plant account. A balance of $80,000 of unfilled orders is reported after cancellation of $30,000,000 war contracts. In the report mention is made of the International General Electric Co., organized to handle the foreign business of the company. The comparative income account follows:

	1918.	1917.
Gross	$216,815,277	$196,926,318
Operating costs	188,439,521	154,634,529
War taxes	13,500,000	5,500,000
Dividends	9,165,622	11,165,882
Surplus	7,939,359	15,737,946
Profit and loss surplus	53,250,661	49,898,699

Big Utilities Company Sold.

The entire stock of the Southern Utilities Co. has been sold by Frank Payne and D. C. Bradley to David G. Fisher & Co., utility engineers, builders and operators of Davenport, Iowa. The consideration is said to be about $2,500,000. While the transfer is effected by the sale of the stock, the corporation remains intact, but the result will be the placing under new management the Centerville street railway, gas, heating and electric lighting plants, the 33 miles of interurban to Mystic and Albia, 240 miles of high-tension transmission line and the heating, lighting and power plants in 25 southern Iowa towns.

Millburn Electric Elects Officers.

At the recent annual meeting of the Millburn Electric Co., Millburn, N. J., the following officers were elected for the ensuing year: President, W. Rollinson Whittingham; vice-president, William W. Renwick; secretary, William W. McCollum, and treasurer, Charles W. Cox.

Electric Companies Permitted to Issue Securities.

In a recent decision handed down by the Public Service Commission, Harrisburg, Pa., permission was granted to the following electric companies to issue securities in the amounts noted for proposed extensions, betterments, etc.: Bradford Electric Co., Bradford, $400,000 in bonds; Citizens' Electric Co., Williamsport, $250,000, bonds; Penn Central Power & Transmission Co., Altoona, $19,000, bonds; Buffalo, Rochester & Pittsburgh Railways Co., Pittsburgh, $4,587,000, and $40,000 bonds; Erie Lighting Co., Erie, $1,850,000; Beaver Balley Traction Co., New Brighton, $100,000; Penn Central Light & Power Co., Altoona, $119,990 bonds; and the Fairmont, Morgantown & Pittsburgh Railroad, $209,000 in bonds.

Fairbanks Morse Earnings Show Large Gain.

The balance sheet of Fairbanks, Morse & Co., as of Dec. 31, 1918, shows a gain of nearly $3,500,000 in surplus after all charges and dividends. The working capital position of the company was materially strengthened. The report gives no accurate indication of earnings. Gross business of the company in 1918 exceeded all records. The balance sheet compares:

ASSETS.

	1918.	1917.
Cash	$ 903,167.30	$ 589,732.45
Accounts receiv.	4,893,009.29	4,572,188.75
Notes receiv.	802,295.30	574,176.45
Inventories	10,540,338.39	6,720,026.96
Foreign branch houses	526,372.53	281,273.92
Current invest.	937,492.30	491,420.83
Current assets.	$18,602,675.11	$13,228,819.40
Unexpired expense	37,434.64	32,179.15
Machinery, etc.	2,700,487.24	2,045,581.84
Furniture and fixtures	101,573.05	93,820.01
Buildings and real estate	2,216,333.17	1,369,085.42
Warehouse	365,189.89	376,969.89
Patents, etc.	1,000,000.00	1,000,874.76
Stock of E. & T. Fairbanks.	1,500,945.00	1,495,745.00
Totals	$26,524,638.10	$19,643,075.47

LIABILITIES.

Accounts pay.	$ 2,275,332.77	$ 2,168,838.74
Notes payable.	2,493,133.08	1,395,129.69
Div. payable	60,000.00	.....
Accrued exp.	186,484.41	4,465.84
Current liabil.	$ 5,014,950.26	$ 3,568,434.27
Res. for taxes and contin.	2,581,175.13	1,214,565.13
Common stock.	2,395,000.00	2,000,000.00
Preferred stock.	1,722,200.00	1,488,900.00
Surplus	14,811,312.71	11,371,176.07
Totals	$26,524,638.10	$19,643,075.47

Order Shows Tendency Toward Lower Rates.

The Public Service Commission of New Jersey has promulgated an order of vital importance to all utilities, as showing a decided tendency toward the lowering of rates which were advanced as a war measure. The commission suspended until March 1, 1920, certain orders for reductions in rates issued by it in 1916 directing four companies in the borough of Queens which are subsidiaries of the Brooklyn Union Gas Co. In its present order the commission provides that the matter shall be reopened on April 15, 1920, unless previously taken up.

John S. Graham of Philadelphia, Pa., and Percy Warner, Nashville, Tenn., have been appointed temporary receivers of the Chattanooga Railway & Light Co., Chattanooga, by Judge E. T. Sanford. At the present time the receivership extends only to the properties of the street railway system, properties of the light department being excepted pending litigation on that phase of the original bankruptcy petition.

Fair Increase in Net Reported by Columbia Gas & Electric.

The annual report of the Columbia Gas & Electric Co. shows a net income for 1918 of $3,912,547.73, an increase of $261,919 compared to the year previous. The total gross earnings were $11,538,772.11, as against $10,861,330.69 for 1917. During the year $3,199,197.73 was placed to surplus.

The company produced 11,997,930 gallons of gasoline, as compared with 11,068,758 the year previous. The oil production was 274,910 barrels, against 198,381. Natural gas sales were 15,880,527,000 cubic feet, as compared with 17,466,125,000 cubic feet in 1917.

In Cincinnati the number of gas customers during 1918 totaled 144,518, as compared with 143,394 in 1917; number of meters in use, 151,051 in 1918, compared with 149,641 in 1917; number of electric customers, 42,844 in 1918, compared with 40,205 in 1917; number of meters in use, 43,822 in 1918, compared with 40,749 in 1917.

Telephone Net Declines.

The net income of 60 telephone companies with annual revenues above $250,000 showed a decrease of $220,000, or 3.7%, during November, 1918, as compared with the total of $5,977,000 for November, 1917. A summary of November revenues and expenses made public recently by the Interstate Commerce Commission showed an increase in gross revenues, however, of more than $2,400,000 above the figures for the same month in 1917, the total reaching $29,497,000.

The Peoples' Telephone Co. of Mercer county has been authorized by the Illinois Public Utilities Commission to issue $25,000 of first mortgage 6% bonds to retire bonds and promissory notes outstanding.

The Cosmopolitan Gas & Electric Supply Co., Inc., 280 Broadway, New York, has filed schedules in bankruptcy, with liabilities listed at $17,168, and assets of $12,756, consisting of stock, machinery, fixtures, etc.

Dividends.

The Belden Manufacturing Co. has declared a stock dividend of 10%, payable to stockholders of record April 28.

Commonwealth Railway & Light Co. has declared a quarterly dividend of 1½% on common stock, also a quarterly dividend of 1¾%, payable May 15 to stock of record May 1.

The Detroit United Railway Co. has declared a quarterly dividend of 2%, payable June 2 to stock of record May 16.

Montreal Light, Heat & Power Co. has declared a quarterly dividend of 1%, payable May 15 to stock of record April 30.

Pacific Lighting Corp. has declared a quarterly dividend of 3% on common stock, also a quarterly dividend of 1¼% on preferred stock, payable May 15 to stock of record April 30.

Southern California Edison Co. has declared a quarterly dividend of 1¾%, payable May 15 to stock of record April 30.

Directors of the J. G. White Management Corp. has declared a quarterly dividend of 1¾% on preferred stock, payable June 1 to stock of record May 15.

Pacific Gas & Electric Co. has declared a quarterly dividend of 1½% on first preferred stock, also a quarterly dividend on the original preferred stock of 1¾%, payable May 15 to stock of record April 30.

The board of directors of the Brooklyn Edison Co. has declared a quarterly dividend of 2%, payable June 2 to stock of record May 21.

Columbia Gas & Electric Co. has declared a quarterly dividend of 1%, payable May 15 to stock of record April 30.

For the Readjustment Period—What?

XXXVI.

Mr. James O'Shaughnessy,
American Association of Advertising Agencies,
Metropolitan Tower, New York.

April 14, 1919.

My Dear Mr. O'Shaughnessy:

Quite as you say in your letter of recent date, the banker of today is studying the potentials of advertising.

The banker's relation to business is from the investment standpoint. He knows that a sound investment depends upon public good will, and that public good will, in a large measure, depends on and is reflected by advertising.

The banker is alive to the fact that advertising is one of the greatest potential forces in business and that it is in command of ultimate values.

A business that pays due regard to the proper use of advertising is a safer investment (all other factors being considered) than a business that ignores advertising.

Sincerely,

HARRY H. MERRICK, Vice-president,
Central Trust Company of Illinois.

On this page of Electrical Review for March 29th appeared a brief summary of the "Elements of Credit." Send for your copy of that issue and read it again—as comment on the above.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Earnings.

RUTLAND SYSTEM.

	March, 1919.	March, 1918.
Gross revenues	$44,681.24	$40,371.27
Operating expenses and taxes	23,552.22	24,619.84
Operating income	$21,129.02	$15,751.43

KANSAS GAS & ELECTRIC.

For the 12 months to March 31—Gross, $2,295,909, increase $516,883; net after taxes, $749,556, increase $238,331; total income, $767,564, increase $256,339; surplus after charges, $344,911, increase $132,134; balance after preferred dividends, $211,752, increase $132,975. March—Gross, $224,565, increase $53,941; net after taxes, $56,606, increase $5859; total income, $56,880, increase $6133; surplus after charges, $16,860, decrease $7544.

TEXAS POWER & LIGHT.

For the 12 months to March 31—Gross, $3,324,580, increase $559,155; net after taxes, $1,078,311, increase $49,611; surplus after charges, $406,353, decrease $43,711; balance after preferred dividends, $157,853, decrease $44,586. March—Gross, $268,713, increase $24,826; net after taxes, $80,309, increase $3051; total income, $80,492, increase $3234; surplus after charges, $25,981, decrease $140.

BLACKSTONE VALLEY GAS & ELECTRIC.

	March, 1919.	12 months.
Gross earnings	$ 191,288	$2,523,077
Surplus after charges.	14,481	377,262

CONSUMERS' POWER.

	March, 1919.	12 months.
Gross earnings	$ 655,423	$7,100,182
Operating expenses	323,353	3,511,741
Net earnings	$ 322,070	$3,588,440
Fixed charges	181,743	2,072,491
Net profits	$ 150,326	$1,515,949
Preferred dividend	50,470	602,408
Balance	$ 99,856	$ 913,540

AMERICAN LIGHT & TRACTION.

The American Light & Traction Co. reports for the 12 months ended March 31, as follows:

	1919.	1918.
Gross earnings	$ 4,302,026	$ 5,162,771
Expenses	274,011	349,369
Net earnings	$ 4,028,015	$ 4,813,402
Previous surplus	12,832,704	12,102,632
Total surplus	$16,860,719	$16,916,034

UNITED GAS & ELECTRIC.

The consolidated report of the United Gas & Electric Corp., and the United Gas & Electric Engineering Corp. for the year ended Dec. 31, last, follows:

	1918.	1917.
Earnings	$ 812,546	$1,228,458
Int. and amortization.	788,898	738,819
Balance	$ 23,648	$ 489,639
Other income	2,840	106,225
Total income	$ 26,488	$ 595,864
Sundry adjustment	5,193	.....
Total	$ 31,681	$ 595,864
1st preferred dividend		417,816
Surplus	$ 31,681	$ 178,048
Previous surplus	803,075	625,027
Total surplus	$ 834,756	$ 803,075

The operations of the subsidiary properties of the corporation, excluding International systems, show the following:

	1918.	1917.
Gross earnings	$8,877,752	$8,031,996
Cperating expenses and maintenance	5,331,147	4,233,062
Net income	$3,546,605	$3,798,934
Taxes	578,710	518,481
Gross corporate income	$2,967,895	$3,280,453
Fixed charges	1,745,377	1,606,165
Balance available for dividends, etc.	$1,222,518	$1,606,165

DAYTON POWER & LIGHT CO.

	March, 1919.	March, 1918.	Three months ended March 31, 1919.	Three months ended March 31, 1918.	12 months ended March 31, 1919.	12 months ended March 31, 1918.
Gross earnings	$244,949	$194,294	$763,782	$582,958	$2,611,553	$1,968,985
Operating expenses (including depreciation and taxes)	154,639	140,683	479,313	428,370	1,712,894	1,356,779
Net earnings	$ 90,319	$ 53,611	$284,469	$154,588	$ 898,659	$ 612,206
Non-operating revenue	2,992	995	7,474	4,731	36,044	12,611
Total income	$ 93,311	$ 54,606	$291,943	$159,319	$ 934,703	$ 624,817
Interest on bonds	$ 32,159	$ 22,071	$ 96,542	$ 63,658	$ 386,395	$ 199,746
Other deductions (includes other interest and sinking fund)	9,637	11,345	32,379	35,617	143,414	128,961
Total deductions	$ 41,796	$ 33,416	$128,921	$ 99,275	$ 529,809	$ 328,707
Net income	$ 51,515	$ 21,190	$163,022	$ 60,044	$ 404,894	$ 296,110
Dividends on preferred stock	15,467	14,813	46,239	44,437	181,354	177,750
Surplus	$ 36,048	$ 6,377	$116,783	$ 15,607	$ 223,540	$ 118,360
Operating ratio	63.13%	72.41%	62.76%	73.48%	65.59%	68.91%

CITIES SERVICE CO.

	12 mos. ending March 31, 1919.	12 mos. ending March 31, 1918.	Month of March, 1919.	Month of March, 1918.
Gross earnings	$21,992,476.08	$19,850,979.25	$1,947,819.09	$1,975,211.82
Expenses	602,971.85	373,635.25	62,922.68	36,767.94
Net earnings	$21,389,504.23	$19,477,344.00	$1,884,896.41	$1,938,443.88
Interest on debentures	700,119.46	2,647.55	170,049.88	191.73
Net to stock	$20,689,384.77	$19,474,696.45	$1,714,846.53	$1,938,252.15
Dividends preferred stock	4,053,131.00	3,842,475.00	342,473.50	335,882.00
Net to common stock and reserves	$16,636,253.77	$15,632,221.45	$1,372,373.03	$1,602,370.15
Number of times preferred dividend was earned	5.10	5.06		
% earned on average amount of common stock outstanding	57.95%	60.21%		
Preferred stock outstanding			$70,901,024.36	
In hands of public		$68,525,110.89		
Owned by company		2,375,913.47		
Common stock outstanding			$35,862,168.92	
In hands of public		$32,500,118.41		
Owned by company		3,362,050.51		
Series B 7% convertible debentures			$12,077,470.00	
In hands of public		$12,073,470.00		
Owned by company		4,000.00		
Series C 7% convertible debentures			$17,500,000.00	
In hands of public		$17,500,000.00		

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Apr. 29.	Bid May 6.
Adirondack Electric Power of Glens Falls, common	6	14	13
Adirondack Electric Power of Glens Falls, preferred	6	74½	74
American Gas & Electric of New York, common	10+extra	119	119
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	241	275
American Light & Traction of New York, preferred	6	97	98
American Power & Light of New York, common	4	57	58
American Power & Light of New York, preferred	6	76	74
American Public Utilities of Grand Rapids, common	..	..	20
American Public Utilities of Grand Rapids, preferred	7	..	30
American Telephone & Telegraph of New York	..	103⅞	103½
American Water Works & Elec. of New York, common	..	5	5
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	59	56
Appalachian Power, common	..	3	3
Appalachian power, preferred	7	10	10
Cities Service of New York, common	+extra	356	365
Cities Service of New York, preferred	6	79	79⅛
Commonwealth Edison of Chicago	8	110	111
Comm. Power, Railway & Light of Jackson, common	..	22½	22
Comm. Power, Railway & Light of Jackson, preferred	6	47	48
Federal Light & Traction of New York, common	..	9½	9
Federal Light & Traction of New York, preferred	..	47	46
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	35	35
Middle West Utilities of Chicago, preferred	6	60	60
Northern States Power of Chicago, common	..	70	70
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	56	57
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	92	92
Public Service of Northern Illinois, Chicago, preferred	6	90	90
Republic Railway & Light of Youngstown, common	4	21	20
Republic Railway & Light of Youngstown, preferred	6	60	60
Standard Gas & Electric of Chicago, common	..	36	38
Standard Gas & Electric of Chicago, preferred	6	43	44½
Tennessee Railway, Light & Power of Chattanooga, common	..	4½	4½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	20	19
United Light & Railways of Grand Rapids, common	4	40	40½
United Light & Railways of Grand Rapids, preferred	6	70½	71
Western Power of San Francisco, common	..	16½	17
Western Union Telegraph of New York	extra	86¼	87½
Industries.			
Electric Storage of Philadelphia, common	4	70	76
General Electric of Schenectady	8	161½	164
Westinghouse Electric & Mfg. of Pittsburgh, common	7	48¾	48
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	55	56½